Vol. 9, No. 4
February 29, 1984

Energy Research Abstracts

Abstracts 5663-7080

Technical Information Center
UNITED STATES DEPARTMENT OF ENERGY

CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications that are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the Energy Data Base of the Technical Information Center; all references are also available for machine searching via the on-line retrieval system, DOE/RECON, and the commercial on-line retrieval systems. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below. Department of Energy components may receive the listed publications free from the Technical Information Center, P. O. Box 62, Oak Ridge, TN 37831. Telephone (615) 576-1303; FTS 626-1303.

PUBLICATIONS OF THE TECHNICAL INFORMATION CENTER

Energy Abstracts for Policy Analysis (EAPA)

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize the following programmatic efforts; legislative, regulatory, and other legal aspects, social, economic, and environmental impacts; regional and sectoral analyses; institutional factors, etc. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402; domestic subscribers $6.00, foreign $7.50 per copy; annual cumulative index, domestic $10.00, foreign $12.50 per copy. The annual subscription price is $70.00 for domestic subscribers and $87.50 for foreign subscribers.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $165.00 for domestic subscribers and $206.25 for foreign subscribers. A single issue costs $9.50 (domestic) or $11.90 (foreign).

DOE Patents Available for Licensing (PAL)

DOE is prepared to grant exclusive or nonexclusive, revocable licenses under DOE-owned U. S. patents and patent applications; this semiannual publication provides abstracting and indexing coverage of this literature. *PAL* is available on subscription as PB84-946800 from the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161. The annual subscription price is $14.00 for domestic subscribers and $28.00 for subscribers outside the North American continent; prices for single issues are $7.00 and $14.00, respectively.

The following monthly update journals are available to the public on subscription from the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22161; use the identifying order number (PB- No.) when subscribing. The annual subscription rate for one volume (calendar) year (12 issues plus cumulative index) is $75.00 for domestic (North America) and $150.00 for foreign (outside North America) subscribers. A single issue is $7.00 (domestic) and $14.00 (foreign).

***Current Energy Patents (CEP)*–PB84-902800**

Provides coverage of the international patent literature, including patent applications, that concerns any aspect of energy production, conservation, and utilization.

***Energy and the Environment (EAE)*–PB84-914900**

Devoted to information on the impacts of energy-related activities and radioactive and nonradioactive pollutants on the environment.

***Fossil Energy Update (FEU)*–PB84-914600**

Devoted to information on the exploration, development, processing, and use of fossil fuels.

***Fusion Energy Update (CFU)*–PB84-915300**

Devoted to information on controlled thermonuclear fusion, including plasma and fuel research and power plant engineering and conceptual design studies.

***Solar Energy Update (SEU)*–PB84-914500**

Devoted to information on the utilization of solar energy, including biomass and tidal and wind power.

The following semimonthly bulletins are also available from the National Technical Information Service (NTIS). The annual subscription rate for one volume (calendar) year (24 issues; no indexes) is $40.00 for domestic subscribers and $80.00 for subscribers outside the North American continent; use the identifying order number (PB- No.) when subscribing. Back issues are available for $5.00 each.

***Acid Precipitation (APC)*–PB84-901000**

Covers all aspects of acid precipitation, including effects and possible control measures.

***Coal-Based Synfuels (CBS)*–PB84-901400**

Covers all aspects of conversion of coal into gaseous or liquid fuels.

***Coal Preparation and Pollution Control (CPC)*–PB84-900800**

Covers all aspects of coal preparation and cleaning and reducing pollution from its direct combustion.

***Direct Energy Conversion (DEC)*–PB84-946600**

Covers the following areas: photovoltaics, magnetohydrodynamics, electrohydrodynamics, thermoelectrics, thermionics, and fuel cells.

***Geothermal Energy Technology (GET)*–PB84-914700**

Devoted to information on the exploration, development, and utilization of geothermal resources.

***Laser Research (LAR)*–PB84-901100**

Covers all aspects of laser research and development, but excludes applications.

***Nuclear Fuel Cycle (NFC)*–PB84-913400**

Covers all aspects of the nuclear fuel cycle, both front end and back end.

***Nuclear Reactor Safety (NRS)*–PB84-913500**

Covers the following safety aspects: accident analysis, safety systems, radiation protection, decommissioning and dismantling, and security measures.

***Radioactive Waste Management (RWM)*–PB84-902900**

Covers the following management aspects: transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers.

***Solar Thermal Energy Technology (STT)*–PB84-901200**

Covers research in materials, concentrators/receivers, salinity gradients, etc., for development of efficient and reliable solar thermal conversion systems.

***Unconventional Petroleum (UCP)*–PB84-901300**

Covers all aspects of secondary and tertiary recovery of petroleum and of oil shales and tar sands.

INTERNATIONAL ENERGY PUBLICATIONS

The Technical Information Center cooperates with the following organizations in the publication of international abstract journals: (1) International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria, for *Atomindex;* (2) International Energy Agency, IEA Coal Research, London, England, for *Coal Abstracts;* and (3) International Energy Agency, Biomass Conversion Technical Information Service, Dublin, Ireland, for *Biomass Abstracts.* In each case, the cognizant foreign agency provides the non-U.S. information to TIC for inclusion in the Energy Data Base; in turn, TIC provides the U.S. information for input into the respective journal.

Atomindex

A semimonthly abstract journal providing worldwide coverage of information on nuclear science and technology. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

Biomass Abstracts

A bimonthly abstract journal with comprehensive coverage of information in any step involved in the eventual conversion of biomass to energy. *Biomass Abstracts* is available free to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Biomass Abstracts* from Biomass Conversion Technical Information Service, Institute for Industrial Research and Standards, Ballymun Road, Dublin 9, Ireland, for 42 IR pounds per year. Make checks payable to the Institute.

Coal Abstracts

A monthly abstract journal providing comprehensive worldwide coverage of information in the field of coal science and technology. *Coal Abstracts* is available to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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ENERGY RESEARCH ABSTRACTS

ABOUT THE TECHNICAL INFORMATION CENTER

The Technical Information Center in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, the Center places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory, energy analysis, and policy-related areas. To accomplish this mission, the Center builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct access to the Center's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of the Center's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Center has developed and maintains systems to record and communicate energy-related research-in-progress information, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications. The Center also maintains a full-scale publishing capability to serve special publication needs of the Department. To effectively manage DOE's technical information resources, the Center's program is one of continual development and evaluation of new information products, systems, and technologies.

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ABOUT *ENERGY RESEARCH ABSTRACTS*

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

ERA is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37831.

ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $165.00 for domestic subscribers and $206.25 for foreign subscribers. A single issue costs $9.50 (domestic) or $11.90 (foreign). The cumulative indexes will be available in printed form from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, and in microfiche form from the National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161, and from Engineered Systems, P. O. Box 866, Oak Ridge, Tennessee 37831.

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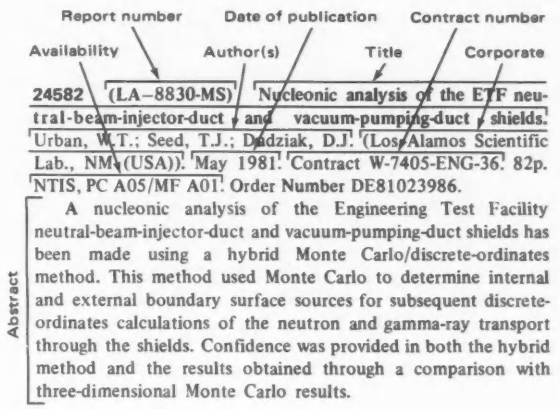
HOW TO USE *ENERGY RESEARCH ABSTRACTS*

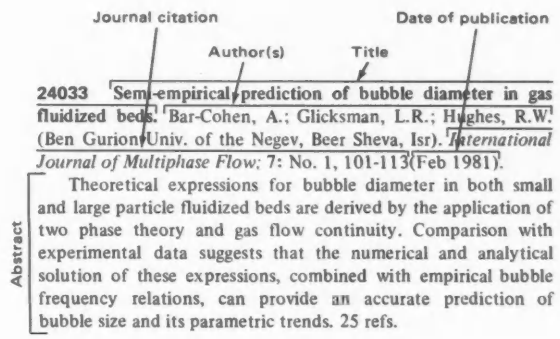
ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.



24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. (Los Alamos Scientific Lab., NM (USA)). May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01. Order Number DE81023986.

A nucleonic analysis of the Engineering Test Facility neutral-beam-injector-duct and vacuum-pumping-duct shields has been made using a hybrid Monte Carlo/discrete-ordinates method. This method used Monte Carlo to determine internal and external boundary surface sources for subsequent discrete-ordinates calculations of the neutron and gamma-ray transport through the shields. Confidence was provided in both the hybrid method and the results obtained through a comparison with three-dimensional Monte Carlo results.



24033 Semi-empirical prediction of bubble diameter in gas fluidized beds. Bar-Cohen, A.; Glicksman, L.R.; Hughes, R.W. (Ben Gurion Univ. of the Negev, Beer Sheva, Isr). *International Journal of Multiphase Flow*; 7: No. 1, 101-113 (Feb 1981).

Theoretical expressions for bubble diameter in both small and large particle fluidized beds are derived by the application of two phase theory and gas flow continuity. Comparison with experimental data suggests that the numerical and analytical solution of these expressions, combined with empirical bubble frequency relations, can provide an accurate prediction of bubble size and its parametric trends. 25 refs.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. **(Los Alamos Scientific Lab., NM (USA)).** May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01. Order Number DE81023986.

is indexed as:

Los Alamos Scientific Lab., NM (USA)
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Bar-Cohen, A., Semi-empirical prediction of bubble diameter in gas fluidized beds, 7:24033 (J:US)
Dudziak, D.J., *See* Urban, W.T., 6:24582
Glicksman, L.R., *See* Bar-Cohen, A., 7:24033
Hughes, R.W., *See* Bar-Cohen, A., 7:24033
Seed, T.J., *See* Urban, W.T., 6:24582
Urban, W.T., Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

TOKAMAK ETF
Neutral Atom Beam Injection
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)
Neutron Transport
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

• Contract Number Index

DOE technical literature is indexed using contract numbers under which the literature was produced. This index contains the contract number with corresponding abstract and report numbers.

W-7405-ENG-36	**Los Alamos National Lab., NM (USA)**	
	6:24582	LA–8830-MS

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under an Order Number, that number is included in the availability statement. An Order Number–Report Number Correlation is included for convenience.

LA–		
8830-MS	**6:24582**	**NTIS, PC A05/MF A01. Order Number DE81023986, Distribution Category STD-20d**

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SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 293 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R5 from NTIS for $9.50.

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01 COAL AND COAL PRODUCTS

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REFER ALSO TO CITATION(S) 6393

5663 **(ACIRL-PR—83-5) Hydroliquefaction of Australian coals: compositional analysis of product oils and recycle solvents.** Fredrickson, P.W. (Australian Coal Industry Research Labs. Ltd., North Ryde). Apr 1983. 44p. Australian Coal Industry Research Labs. Ltd., North Ryde.

Several different types of Australian coal were hydrogenated in a continuous reactor under recycle solvent operation at 21 MPa and 400-430 C. Results of analyses of light product oils and recycle solvent are given. (29 refs.)

5664 **(BMFT-FB-T—83-191) Production of syncrudes and high-value solid fuels from low grade coal, peat and biowaste by reaction of water-slurries with carbon monoxide.** Duerkop, A.; Korff, R.; Haeffner, E.; Hartmann, U.; Uy Nguyen-Huu; Oelert, H.H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Sep 1983. 173p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84750340.

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Prestudies of the mechanism for the waterphase carbon monoxide (CO) reaction of substances representative for the (titled) feeds were made by autoclave- and labscale continuous experiments. Lignites, peat and biowaste were preoptimised by autoclave experiments treating water slurried feeds with pressurized CO at 30 min residence time in the range of 350 to 450°C at system pressures up to 500 bar. A benchscale PDU (kg/h) was designed and put in operation for waterslurried feeds under CO-pressure applied to lignites for 290-340°C, peat for 330-400°C, and sewage-plant sludge for 340-350°C. The products from continuous PDU-runs were separated offline, balanced, and evaluated by different analytical methods. Inspite of sometimes high conversions, the yield and quality of liquid products is rather low for this type of reaction in comparison with oilphase liquefaction. Some positive aspects for the dewatering of lignites and the production of special compounds are given.

5665 **(CONF-830812—61) Dynamic response of the U-GAS gasifier.** Rehmat, A.; Bryan, B.G.; Goyal, A. (Institute of Gas Technology, Chicago, IL (USA)). 1983. 7p. Institute of Gas Technology, 3424 S State Street, ITT Center, Chicago, IL 60616.

From 18. intersociety energy conversion engineering conference; Orlando, FL, USA (21 Aug 1983).

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Information has been obtained under controlled conditions, in a 24 tons per day U-GAS gasification pilot plant fluidized-bed gasifier, on the dynamics of and methodology for changes in gas output from the gasifier under several types of load changes, and on the effect of step changes in the three independent feed streams - coal, steam, and oxygen - on the performance of the gasifier. Data have also been obtained on reestablishing normal operation of the gasifier following stoppage of all gas flows to the gasifier, which would occur during a power failure, and would result in the complete defluidization (slump) of the bed. An automatic bed temperature control system for the gasification zone, which maintains desired temperatures during all interruptions, was also tested. A dynamic computer model of the U-GAS gasifier corresponding to this study has also been developed. 4 references, 6 figures, 2 tables.

5666 **(CONF-831112—1) Recent developments with IGT's U-GAS process.** Bush, J.R.; Sandstrom, W.A. (Institute of Gas Technology, Chicago, IL (USA)). 1983. 22p. IGT, 3424 South State St., IIT Center, Chicago, IL 60616.

From Coal technology '83 - international coal utilization convention; Houston, TX, USA (15 Nov 1983).

Recent operation of IGT's U-GAS pilot plant in Chicago has established wide flexibility in operation and has demonstrated a reliable and rapid response to rigid load-following requirements. Coal feedstocks containing high ash (up to 30%) and with widely varing content during a single test (10% to 35% ash variation) have been successfully gasified with over 98% coal utilization. Total fines recycle to the fluidized bed has been demonstrated with the fines ash content incorporated into the ash agglomerates and discharged. A proprietary cyclone design has successfully eliminated all ash deposits and provided reliable long term gasifier operation. The large data base established in over 130 pilot plant tests in now being used by Memphis Light, Gas & Water to design a large scale U-GAS gasification plant and by Charbonnages de France to design and build a 200 TPD high pressure U-GAS pilot plant. 5 references, 12 figures, 5 tables.

5667 **(CONF-8311109—1) Thermal conductivities of Wilsonville solvent and Wilsonville solvent/Illinois No. 6 coal slurry.** Wilson, J.H.; Sams, T.L.; McWhirter, D.A. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 18p. NTIS, PC A02/MF A01. Order Number DE84003392.

From Direct coal liquefaction contractor's review conference; Pittsburgh, PA, USA (16 Nov 1983).

Thermal conductivities of a Wilsonville solvent and of a slurry prepared from this solvent and Illinois No. 6 coal have been measured at temperatures ranging from 295 to 500°K. With increasing temperature, the thermal conductivity varied from 1.23 to 0.93 mW/(cm K) and from 1.51 to 1.02 mW/(cm K) for the solvent and the slurry, respectively. At room temperature, measurements on toluene were accurate to within 3% of literature values.

5668 **(DOE/ET/10495—29) Catalytic hydrogenation of coal-derived liquids. Final report, October 1982-September 1983.** Berg, L.; McCandless, F.P. (Montana State Univ., Bozeman (USA). Dept. of Chemical Engineering). Oct 1983. Contract AC22-76ET10495. 34p. (FE—2034-29). NTIS, PC A03/MF A01. Order Number DE84003370.

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Seven catalysts, fabricated by impregnating various concentrations of nickel, molybdenum, cobalt and tungsten on a gamma-alumina support, were investigated for their activity in upgrading SRC-II Light Ends Column Feed in a trickle bed reactor. The effect of water on the catalyst activity was also investigated. Operating conditions were: pressure of 6.9 MPa, temperature of 405°C, hydrogen flow rate of 1.9 sl/min., and LHSV of 1.0 hr^{-1}. Two percent water was added to the feed for the runs which applied this technique. The most active catalysts were Ni-Mo for hydrodenitrogenation and Co-Mo for light oil production. Ni-W and Mo-W both reduced the activity when they were present in a catalyst and the least active catalyst was Ni-Mo-W. Water enhanced activity of the Ni-Mo and Co-W catalysts but inhibited that of Co-Mo-Ni-W, Ni-W and Co-Mo-W catalysts.

5669 **(DOE/ET/14928—1517) Experimental evaluation of the steady state and dynamic performance characteristics of the interactive units of a coal gasification process. Quarterly report, 27 September 1982-26 December 1982.** (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.). Apr 1983. Contract AC21-80ET14928. 50p. NTIS, PC A03/MF A01. Order Number DE84003966.

Coal gasification/gas cleanup fuels plants for synthetic fuel applications must be developed within two sets of constraints: one imposed by dynamic load response to variations in end-use demand, the other by the need to comply with environmental regulations. The overall objective of the program is to establish the technology base required to operate within those constraints. In order to establish that base, system and component performance of the fuels plant are being characterized in both steady state and dynamic operation; and the information required to establish system control logic is being developed. An integrated coal gasification system composed of proven process units (i.e., a Process Evaluation Facility - PEF) at the contractor's site is being used to perform tests for establishing an information base to: establish performance parameters for each process unit; define dynamic interactions of process units operating under variable loads; characterize effluent flow streams from the process; and develop an experimentally verified simulation model for integrated system operations. The combined experimental-analytical approach employed will yield empirically verified performance projections for full-scale systems. Accomplishments for this past quarter are presented for the following six tasks: (1) test program definition and analysis; (2) facility operation; (3) system modeling; (4) component support requirements; (5) fuel system modifications; and (6) program management.

5670 **(DOE/PC/50805—T1) Acid-catalyzed depolymerization of coal by hydride donors. Quarterly report, August 1-October 31, 1983.** Miller, B. (Massachusetts Univ., Amherst (USA)). 1983. Contract FG22-82PC50805. 9p. NTIS, PC A02/MF A01. Order Number DE84002943.

Reduction of 1-methylthionaphthalene (1a) to naphthalene by solutions of potassium iodide and trifluoromethane sulfonic acid in trichloroacetic acid was observed. Other acids were studied as catalysts for the reduction of 1a. No reaction was observed with p-toluenesulfonic acid, while sulfuric acid caused rapid charring. Reaction with phosphoric acid proceeded significantly slower than that with trifluoromethanesulfonic acid. Reduction of the following model compounds were also studied and compared: 1-phenylthionaphthalene; 2-methylthionaphthalene; diphenyl sulfide; di-1-naphthylsulfide; 1-naphthalenthiol.

5671 **(GAO/RCED—83-112) Status of the Great Plains coal gasification project.** (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 8 Apr 1983. 35p. US General Accounting Office, Document Handling and Information Services Facility, PO Box 6015, Gaithersburg, MD 20760.

Report to the Congress.

ANG has extensive policies and procedures for overseeing the construction of the Great Plains project. Additional management comes from a computerized information system, various audit groups, and staff located at the project site. Neither we nor any other audit group identified significant deficiencies in ANG's computer system or the individual systems which feed into it. Overall, the system contains both automated and manual controls which ensure that the data generated from the system is reliable and accurate. The various audit and evaluation groups provide management continuous and significant information concerning major project components. Great Plains management recognized the usefulness of the information and acted on recommendations made which enhanced its overall effectiveness. ANG established and implemented comprehensive procedures to oversee the project's construction. These procedures appear adequate for managing and controlling all construction activities. For example, ANG's onsite managers have identified problems and suggested actions which ANG believes minimized the effect of these problems on the construction schedule. The Department of Energy has extensive procedures for monitoring this project. With few exceptions, the Department followed the procedures established. It has not, however, completed its audit of incurred costs to determine that loan guarantee funds are spent only for eligible project costs. Such an audit was underway and the Department expected to complete it in 1983.

5672 **(LBL—16773) Chemistry and morphology of coal liquefaction. Annual report, October 1, 1982-September 30, 1983.** Heinemann, H. (Lawrence Berkeley Lab., CA (USA)). Sep 1983. Contract AC03-76SF00098. 76p. NTIS, PC A05/MF A01. Order Number DE84003923.

The kinetics of Fischer-Tropsch synthesis over a potassium-promoted, fused-iron catalyst were studied as a function of catalyst reduction conditions. Severe reduction leads to a very active catalyst, which deactivates rapidly. Milder reduction conditions give a less active but more stable catalyst. Differences in the order of dependence on H_2 and CO and the fact that activation energies are independent of reduction condition suggest that different fractions of the surface are brought into an active state. A study of potential support-metal interaction was undertaken. There are significant differences in the product spectrum between fused Fe_2O_3 and precipated Fe_2O_3 catalysts. Supported iron on silica, mordenite, y-zeolite and ZSM-5 indicated that chain growth probability is the same for all these supports. Olefin to paraffin ratio increases with increasing Al/Si ratio. Dependencies of rates of formation of individual products on H_2 and CO partial pressure are different for each support. Powdered graphite samples loaded with various amounts of KOH have been reacted with atmospheric pressure of steam in the temperature range 700 to 900°K. The reaction proceeds via two successive stages. During Stage 1, hydrogen and hydrocarbons are evolved at a high rate but no CO or CO_2. During Stage 2, gasification proceeds catalytically at a much reduced rate with the production of one CO molecule per equivalent H_2 molecule. While the results with graphite described indicate a stoichiometric reaction, recent work with an Illinois No. 5 char shows that hydrocarbon production does not stop when all potassium hydroxide has been converted. It appears that an ash component catalytically decomposes the phenolate at reaction temperature, reconstitutes the potassium hydroxide and permits a continuous hydrocarbon production.

5673 (LBL—16773, pp A.1-A.26) **Role of KOH in the low temperature steam gasification of graphite: identification of the reaction steps.** Delannay, F.; Tysoe, W.T.; Heinemann, H.; Somorjai, G.A. (Lawrence Berkeley Lab., CA). Sep 1983. NTIS, PC A05/MF A01.

In Chemistry and morphology of coal liquefaction. Annual report, October 1, 1982-September 30, 1983.

The reaction of a KOH-loaded graphite powder with atmospheric pressure of steam in the temperature range 700 to 900K proceeds via two successive stages. During stage I, hydrogen and hydrocarbons are evolved at a high rate but no CO or CO_2. The stage ceases after the equivalent of 0.5 molecules of H_2 per potassium in the sample are produced. During stage II gasification proceeds catalytically at a much reduced rate with the production of one CO molecule per equivalent H_2 molecule. The absence of CO or CO_2 evolution during stage I indicates the formation of a stable oxygen-containing compound. This compound may be decomposed thermally by heating the sample up to 1300K. CO evolves almost exclusively during this high temperature treatment. These results suggest a step reaction mechanism involving (1) the dissociative adsorption of water forming C-H and C-OH (phenol) groups, (2) the formation of a K-O-C entity (phenolate), from the reaction of KOH with the phenol groups, (3) the decomposition of these K-O-C entities to give CO, K_2O and perhaps metallic potassium and (4) the formation of KOH from reaction of K_2O with water. The transition from stage I to stage II is due to the consumption of KOH to form K-O-C species. The rate of the catalytic reaction (stage II) is controlled by the slowest step (3).

5674 (LBL—16773, pp B.1-B.25) **Distribution of reaction products in the KOH initiated low temperature steam gasification of graphite.** Delannay, F.; Tysoe, W.T.; Heinemann, H.; Somorjai, G.A. (Lawrence Berkeley Lab., CA). Sep 1983. NTIS, PC A05/MF A01.

In Chemistry and morphology of coal liquefaction. Annual report, October 1, 1982-September 30, 1983.

Powdered graphite samples loaded with various amounts of KOH have been reacted with atmospheric pressure of steam in the

temperature range 700 to 900K. Significant amounts of C_1 to C_6 hydrocarbons are found in the gaseous products of this reaction. Both the abundance of these hydrocarbons with respect to hydrogen and their relative distribution varies as a function of reaction time, KOH loading and temperature. A model for their production is proposed according to which C-H groups are stabilized by the formation of a potassium phenolate type compound at the prismatic edge of graphite. Hydrocarbon would then be produced from the direct hydrogenation of surface carbon atoms. The hydrocarbon distribution shows large deviations from the ideal Schulz-Flory distribution, giving little support to a chain growth type mechanism.

5675 **(MLM—3120) Ultrafast rate hydropyrolysis of coal. Final report.** Park, W.K.; Mayer, R.L. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 15 Nov 1983. Contract AC04-76DP00053. 58p. NTIS, PC A04/MF A01. Order Number DE84004049.

Experiments using a continuous-flow jet reactor were conducted to achieve a better understanding of the fundamental physicochemical phenomena that occur during ultrafast-rate hydropyrolysis of coal. The jet reactor consists of four functional stages, which provide the fast-rate heating, jet mixing, short reaction time, and rapid product quenching conditions required to promote and study the desired fast-rate reactions. Powered coal was used as the primary feed, and conditions were varied to achieve: reaction temperatures from 900 to 1250°; reaction times from 3 to 60 ms; reaction media from neutral to reducing conditions; and coal-to-gas ratios from 0.2 to 0.5. Results show that up to 86% of the coal can be converted to gaseous products within 5 ms reaction time, and hydrocarbons or synthesis gas may be selectively produced, as desired. The data should extend the existing short-residence-time data base in the 3 to 5 ms reaction time range. 10 references, 26 figures, 10 tables.

5676 **(MLM-MU—83-71-0001) History of the Fort Lewis Solvent Refined Coal pilot plant component performance.** DeWitt, R. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). Nov 1983. Contract AC04-76DP00053. 155p. NTIS, PC A08/MF A01. Order Number DE84004978.

This report is a compilation of the critical component operating experience of the Solvent Refined Coal (SRC) pilot plant at Fort Lewis, Washington. Monthly, quarterly, and annual technical progress reports, as well as topical reports were reviewed for performance information concerning pumps, valves, instruments and controls, materials and heaters and heat exchangers. The component information is presented as a component performance synopsis, a performance summary followed by a chronological listing of the significant component operational events. This report should serve as convenient locater of information that has appeared in the various pilot plant reports as well as to serve as a rapid overview of the history of component problems at the SRC pilot plant.

5677 **(ORNL/FMP—83/4) Advanced Research and Technology Development Fossil Energy Materials Program. Quarterly progress report for the period ending September 30, 1983.** (Oak Ridge National Lab., TN (USA)). Nov 1983. Contract W-7405-ENG-26. 476p. NTIS, PC A21/MF A01. Order Number DE84004145.

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The objective of the AR and TD Fossil Energy Materials Program is to conduct research and development on materials for fossil energy applications with a focus on the longer-term and generic needs of the various fossil fuel technologies. The program includes research aimed toward a better understanding of materials behavior in fossil energy environments and the development of new materials capable of substantial enhancement of plant operations and reliability. The management of the Program has been decentralized to DOE Oak Ridge Operations Office (ORO) and the Oak Ridge National Laboratory (ORNL) as technical support contractor. The ORNL Fossil Energy Materials Program Office compiles and issues this combined quarterly progress report from camera-ready copies submitted by each of the participating subcontractor organizations. This report of activities on the program is organized in accordance with a work breakdown structure defined in the AR and TD Fossil Energy Materials Program Plan for FYs 1982 to 1986 in which projects are organized according to fossil energy technologies. It is the intent of the AR and TD Fossil Energy Materials Program to sponsor materials research which is generic to a number of fossil energy technologies. We hope this series of AR and TD Fossil Energy Materials Program quarterly progress reports will aid in the dissemination of information developed on the program.

5678 **Solvolytic liquefaction of coal in the presence of poly(vinylcyclohexane).** Sekiguchi, Y.; White, D.H. (Department of Chemical Engineering, University of Arizona, Tucson, AZ 85721). *Fuel;* **62**: No. 8, 908-912(Aug 1983). Contract FG01-77ET10657.

Coal liquefaction in the presence of poly(vinylcyclohexane) (PVCH) was studied at 400°C under an atmosphere of nitrogen. PVCH promoted coal conversion better than tetralin (27.8% for tetralin, 47.2% for preheated PVCH). The effects of the initial molecular weight of PVCH, of free radicals formed during a decrease in molecular weight, and of changes in molecular structure with decomposition were examined. Conversion increased with increased initial molecular weight between 112 amu (ethylcyclo hexane) and 700 amu (low molecular weight PVCH); no effect was found for molecular weights greater than 700. The best conversion was obtained when preheated PVCH was used, resulting from formation of allylic hydrogens. Aromatic structures were not found in the preheated PVCH. It is concluded that PVCH with molecular weights of $\approx$ 700 amu with allylic hydrogens present promoted the liquefaction of coal better than tetralin.

5679 **Thermodynamics of hydrogen bonding in coal-derived liquids. Failure of the Bolles-Drago approach applied to mixtures.** Weyrich, O.R. Jr.; Larsen, J.W. (Department of Chemistry, University of Tennessee, Knoxville, TN 37996). *Fuel;* **62**: No. 8, 976-977(Aug 1983).

The validity of using the Bolles-Drago technique to calculate thermodynamic functions for the hydrogen bonding interactions of an acid with a pair of bases was tested by computer. Sets of 'data' were calculated for five cases having different enthalpies and free energies of association and these 'data' were used in the Bolles-Drago treatment to recalculate the thermodynamic parameters. If the enthalpies and free energies of association of the acid with the two bases are different, the Bolles-Drago treatment fails.

5680 **Extents and models of adduction of hydrocarbon and nitrogen-containing solvents in coal liquefaction.** McNeil, R.I.; Cronauer, D.C.; Young, D.C. (Gulf Research and Development Company, P.O. Drawer 2038, Pittsburgh, PA 15230). *Fuel;* **62**: No. 7, 806-812(Jul 1983). Contract AC22-80PC30080.

Coal liquefaction experiments have been carried out to determine the tendency for adduction of several hydrocarbon- and nitrogen-containing structures typical of coal. Principal conclusions are: that even good hydrogen donors such as tetralin and octahydrophenanthrene are adducted readily; that benzyl radicals adduct primarily by radical-radical reaction, yielding thermally labile products; and that quinoline adducts to coal-derived liquids primarily by hydrogen bonding with little formation of C-C or C-N bonds.

5681 **Mutagenesis and skin tumour initiation by shale- and coal-derived oils and their distillation fractions.** Calkins, W.H.; Deye, J.F.; Hartgrove, R.W.; King, C.F.; Krahn, D.F. (Central Research and Development Department, E.I. du Pont de Nemours and Company, Wilmington, DE 19898). *Fuel;* **62**: No. 7, 857-864(Jul 1983).

Crudes and distillation fractions of three shale- and four coal-derived liquids and petroleum were screened for mutagenic activity in Salmonella typhimurium strains TA1535, TA1537, TA1538, TA98 and TA100, and for tumour initiating activity in mouse skin. Selected analytical tests were also conducted to identify and characterize the crudes and fractions. Low boiling (naphtha) fractions of all crudes showed no biological activity. The higher boiling fractions, the residues and the crude oils were mutagenic and initiated tumours. Some coal-derived liquid fractions were significantly more active by either test than similar boiling range frac-

tions of petroleum and shale-derived oils. The mutation frequencies (revertants μg^{-1}) as well as the total number of tumours were also related to the C/H weight ratios of the various fractions, supporting the view that aromatic compounds may be responsible for some of those activities. In most cases, the expression of mutagenic activity required an activation system, although a few fractions of shale- and coal-derived oils were weakly active without activation. In general, there was a strong positive relationship between the mutation data and the initiation-promotion data. Two linear relations were observed between the total number of skin tumours and the mutation frequencies in strains TA1538, TA1537 and TA100: one is associated with the medium boiling fractions while the other includes the residues and crude liquids.

5682 **Combustion properties of EDS liquefaction bottoms.** Winegartner, E.C.; Sondhi, D.K. (Exxon Research and Engineering Company, Baytown Research and Development Division, P.O. Box 4255, Baytown, Texas 77520). *American Society of Mechanical Engineers, [Paper];* No. 83-FU-2, 8(1983).

The use of vacuum bottoms to provide heat in coal liquefaction processes by burning them in a hybrid boiler requires that information be developed regarding their combustibility, their fouling and slagging behavior in the furnace, and their particulate and gaseous emissions. Laboratory characterization studies and pilot-combustor tests carried out at Baytown are summarized in this report. The inherently lower reactivity of the bottoms does not adversely affect combustibility because lower reactivity can be compensated for by finer grinding which is readily accomplished with this very friable material. Data are presented which show that the usual volatile matter test is not a good predictor of combustibility for this material. The effect of composition on combustibility is investigated using the combustion profile technique.

5683 **PEATGAS pilot plant operating results.** Biljetina, R.; Punwani, D. (Institute of Gas Technology, Chicago, IL). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 2: 820-824(Aug 1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

The Institute of Gas Technology has been developing the PEATGAS process for the conversion of peat to synthetic fuels. A program has recently been completed for the pilot-plant-scale testing of the process. In this scheme, peat is gasified in a two-stage reactor system, which operates at temperatures up to 1750°F and pressures up to 500 psig. The process can be controlled to maximize the production of either substitute natural gas (SNG) or liquid hydrocarbons. The technical feasibility of the process was demonstrated in a series of five gasification tests. Highlights of this operating program are presented in this paper.

5684 **Regeneration of spent catalysts from coal liquefaction and petroleum residual processing operations.** Ganguli, P.S. (Hydrocarbon Research Inc., Lawrenceville, WI). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 2: 825-830(Aug 1982). (CONF-820814—). Contract AC05-77ET10152.

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

HRI has developed a catalyst regeneration procedure for spent catalysts from both coal liquefaction and heavy petroleum residual upgrading operations to remove carbonaceous matter as well as most of the metal contaminants by chemical treatment. Test results show that activities of the regenerated catalysts from the H-Coal Process were either superior or equivalent to those of fresh catalyst. Useful vanadium and nickel salts can be reclaimed. The regeneration process is being optimized and readied for commercial application.

5685 **Evaluation of coking behavior in coal liquefaction process equipment.** Lin, K.H.; Edwards, R.E.; Frazier, G.C. (Oak Ridge National Laboratory, Oak Ridge, TN). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 2: 831-837(Aug 1982). (CONF-820814—). Contract W-7405-ENG-26.

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

Formation/deposition of coke-like solids in process equipment represents one of the crucial problems in coal liquefaction processes, yet the causes for such behavior are not well understood. This paper presents the results of the state-of-the-art review in understanding coking behavior, with an emphasis on possible application to coking in coal liquids. Accessible data from the literature relevant to coking are concerned primarily with petroleum liquids and appear to be scattered, largely qualitative in nature, and sometimes inconclusive. Few experimental coking studies have been made using coal-derived liquids. Preliminary dimensional correlations that resulted from a comprehensive analysis of the coking data from preheater test runs in the Wilsonville coal liquefaction pilot plant are also presented. The correlations indicate process conditions and certain coal characteristics that may lead to incipient coke formation. Further studies and additional data are required to refine these correlations.

5686 **Study of thermal coal dissolution and liquefaction in the H-COAL preheater.** Yu, R.K.; Comolli, A.G.; Hippo, E.; Johanson, E. (Hydrocarbon Research, Inc., Lawrenceville, New Jersey 08648). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 2: 844-849(Aug 1982). (CONF-820814—). Contract AC05-77ET10152.

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

Under the sponsorship of the Department of Energy and industrial participants, HRI is investigating the thermal dissolution of coal and its effect on the mechanism of coal liquefaction in the H-COAL Process. An understanding of the coal dissolution step is fundamental to process improvement and sound process design. This paper reports mainly on thermal dissolution in a coil preheater and microautoclave tests using Illinois No. 6 coal and hydrogenated coal tar distillate as solvent. Some data on two stage liquefaction is also included. The resulting asphaltenes, preasphaltenes, and oil distributions were measured to study the mechanism of coal liquefaction. The process variables investigated included space velocity and the preheater temperature profile.

5687 **Solids dispersion modelling in coal liquefaction dissolvers.** Moujaes, S.; Sivasubramanian, R.; Ying, D.H.S. (Int. Coal Refining Company, Allentown, PA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 2: 850-853(Aug 1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

A major element of the coal dissolution section of any liquefaction plant is the dissolver. The design of the SRC-I Demonstration Plant Dissolver will be based on data generated from the Wilsonville and Ft. Lewis dissolvers. The superficial liquid and gas velocities in the commercial dissolver will be about five to seven times larger than those in the Wilsonville dissolver. This increase will have a considerable impact on the process since gas, liquid velocities and feed concentration will have a strong effect on solids concentration in the dissolvers. An axial solids dispersion model is developed to describe solids concentration profiles in a gas/liquid/solid three-phase upflow column (30 cm diameter by 7.62 m). This column closely resembles the dimensions of the Wilsonville Plant Dissolver. The fluid phase tested in this model includes water, tetralin and glycol-water solution at various compositions. The particles tested were 140 minus mesh and 60/80 mesh sand which represent a reasonable range of particle sizes that might be found in the SRC-I plant dissolver.

5688 **Advances in two-stage liquefaction.** Neuworth, M.B. *Energy Technology (Washington, D.C.);* 596-603(Jun 1982). (CONF-820217—).

From 9. energy technology conference; Washington, DC, USA (16 Feb 1982).

A two-stage liquefaction process which provides a high quality distillate with efficient management of hydrogen consumption has been developed. A generic two stage process is schmaticized. In this paper a flowsheet for the integrated two stage unit located at the CE Lummus Engineering Co in New Brunswick NJ is shown. Details of the breakdown are given. The desired reduction in overall hydrogen consumption was obtained. Production of syncrude is compared with SRC II, and H-COAL. The cost impli-

cations of projected improvements are calculated. Scaleup risk has been reduced by demonstrating the use of LC-Fining, a commercial petroleum hydrocracking process, to the second stage for distillate production and effective hetero-atom elimination.

5689 **An assessment of gasifier alternatives for carbonate fuel cell power plant.** Bonds, T.L. (General Electric Co., Ballston Spa, NY 12020). *Energy Technology (Washington, D.C.);* **9**: 655-664(Jun 1982). (CONF-820217—).

From 9. energy technology conference; Washington, DC, USA (16 Feb 1982).

This report assesses the technical parameters which affect the selection of a preferred coal gasification process for a carbonate fuel cell power plant. The principles and components of fuel cells are outlined. Molten carbonate fuel cell power plant system concept is schematized. As the degree of optimization of the thermodynamic cycle depends on the specific gasifier, four types are compared: entrained bed with high exit temperature, the same with low exit temperature, fluidized bed, and moving bed. Two choices must be made: air blow versus oxygen blow gasification, and which gasifier types. In general, a high output of hydrogen and carbon monoxide is desired. A wide range of gasifiers is acceptable, and technically feasible. Ultimate selection depends upon demonstration.

0106 Properties

REFER ALSO TO CITATION(S) 5663, 5679, 5680, 5681, 5697, 5705, 5708, 5710, 5716, 6307

5690 **(DOE/PC/30013—F5) Data base for the analysis of compositional characteristics of coal seams and macerals. Final report, Part 5. Recent FT-IR and ^{13}C NMR studies of coal structure.** Painter, P.C.; Davis, A.; Starsinic, M.; Koenig, J.L.; Havens, J.R.; Kuehn, D.W.; Snyder, R.W.; Senftle, J.T.; Rhoads, C.; Riesser, E. (Pennsylvania State Univ., University Park (USA). Coal Research Section). Oct 1983. Contract AC22-80PC30013. 130p. NTIS, PC A07/MF A01. Order Number DE84003215.

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The application of Fourier transform infrared (FT-IR) spectroscopy and solid state ^{13}C NMR spectroscopy, using magic-angle spinning in conjunction with cross-polarization and high-power decoupling has been used to obtain some parameters of coal structure. Problems associated with the application of FT-IR to the characterization of coal structure are critically discussed and the controversies concerning band assignemnts are considered. The application of computer routines to the determination of OH and C-H groups and the use of established criteria for curve fitting are discussed. Topics discussed are: (1) fundamentals of FT-IR; (2) methods for the quantitative determination of functional groups in coal by FT-IR; (3) results of FT-IR studies of a set of vitrinite concentrates; (4) fundamentals of solid state ^{13}C NMR studies of coal; (5) results of ^{13}C NMR studies of a set of vitrinite concentrates; (6) calculation of structural parameters from combined FT-IR and ^{13}C NMR results; (7) correlation of FT-IR measurement to thermoplastic and liquefaction behavior; and (8) FT-IR and ^{13}C NMR studies of coal oxidation. 97 references, 64 figures, 8 tables.

5691 **(DOE/PC/50797—T4) Novel analytical approaches to the study of coal beneficiation. Quarterly report.** Griffiths, P.R. (California Univ., Riverside (USA)). 1983. Contract FG22-82PC50797. 9p. NTIS, PC A02/MF A01. Order Number DE84003694.

Work in the final quarter of the first year of this grant centered on three objectives: (1) Assignment of bands in the spectrum of coal appearing in the region between 900 and 700 cm^{-1} after Fourier self-deconvolution (FSD). (2) Development of techniques for obtaining accurate quantitative information from spectra through the application of least-squares curve-fitting routines. (3) The construction of a light-pipe gas cell for the investigation and characterization of gaseous products from coal reactions. 2 references, 2 figures.

5692 (LA—9907-OBES, pp 147-158) **Field classification system of organic-rich sediments.** Kearns, F.L.; Davison, A.T. (Louisiana Geological Survey, Baton Rouge). Oct 1983. NTIS, PC A11/MF A01. (CONF-8309131—).

From Mineral matter in peat workshop; Los Alamos, NM, USA (26 Sep 1983).

Inconsistent nomenclature and the lack of a standardized classification present problems of communication between scientists studying environments favorable for organic accumulation. Based on percent organic matter, a six-interval semiquantitative classification has been formulated. With the use of the appropriate term for inorganic texture (IT), sediments are categorized in order of increasing organics, as follows: (1) IT, < 5% organics; (2) mucky IT, 5 to 15% organics; (3) IT muck, 15 to 35% organics; (4) muck (IT), 35 to 55% organics; (5) peaty muck (IT), 55 to 75%; (6) peat (IT), > 75% organics. The chemical and physical properties of the sediment at >35% are dominated by the organics; therefore, the IT is placed in parentheses after the organic term. A total of 228 sediment samples were taken in the Louisiana Coastal Plain, and a hand-squeezing field technique was used to estimate organic content. The organic content of samples containing <60% organics - IT, mucky IT, IT muck and muck (IT) - were generally underestimated in the field; conversely, sediments with ≧ 60% organics - peaty muck (IT) and peat (IT) - on the average were overestimated. This system will help scientists to describe organic and inorganic constituents of sediments in a consistent, quantitative fashion, thus enabling workers to more effectively compare data from other sources. 12 references, 5 figures, 1 table.

5693 (LA—9907-OBES, pp 169-178) **Techniques for applying scanning electron microscopy to the study of mineral matter in peat.** Raymond, R. Jr.; Andrejko, M.J.; Bardin, S.W. (Los Alamos National Lab., NM). Oct 1983. NTIS, PC A11/MF A01. (CONF-8309131—).

From Mineral matter in peat workshop; Los Alamos, NM, USA (26 Sep 1983).

Scanning electron microscopy (SEM) and energy dispersive spectrometry (EDS) have been used for in situ analysis of minerals in peats by combining methods for producing oriented microtome sections of peat with methods for critical point drying. The combined technique allows SEM analysis of the inorganic components and their associated botanical constituents, along with petrographic identification of the botanical constituents. In peat deposits with abundant fluvial- or marine-derived minerals, one may use the above technique and/or medium- or low-temperature ashing followed by x-ray diffraction to readily identify the various mineral components. However, in some freshwater environments the scarcity of nonsilica minerals makes the above techniques impractical. By separating the inorganic residues from the peat, one can isolate the nonsilica mineral matter in the SEM for analysis by EDS. Furthermore, such separation allows SEM analysis of features and textures of both silica and nonsilica mineral particles that would otherwise be unidentifiable. 17 references, 11 figures.

5694 **(NP—4900503) Organic and pyritic sulfur in coal: potential errors in determination.** Stanton, R.W.; Renton, J.J. (West Virginia Geological and Economic Survey, Morgantown (USA)). 1981. 15p. NTIS, PC A02/MF A01. Order Number DE84900503.

In most laboratories, sulfur species in coal are determined by the ASTM D2492 procedure, which is based upon the preferential leaching of sulfate minerals and pyrite. Where acid leaching does not completely remove pyrite from the coal, reported pyritic sulfur values will be low, and corresponding organic sulfur values will be high, thus adding to an inaccurate characterization of a particular coal sample. Finely disseminated pyrite can be insulated against leaching if contained within coal macerals or clay aggregates, even if samples are pulverized to less than 60 mesh.

5695 **Reaction of coals in hot acidic phenol at constant acid concentration.** Larsen, J.W.; Lee, D. (Department of Chemistry, University of Tennessee, Knoxville, TN 37919). *Fuel;* **62**: No. 8, 918-923(Aug 1983).

Previous work showed that the efficient 'depolymerization' of bituminous coals in hot phenol containing p-toluenesulphonic

acid failed to occur and that the acid was destroyed during the reaction. Four coals varying in rank from lignite to low volatile bituminous were treated with refluxing phenol containing p-toluenesulphonic acid with the acid concentration held constant. The amount of colloidal material, of pyridine-soluble material, of benzene-ethanol solubles, and the number average molecular weight of the pyridine extractables were measured as a function of time. Although the reaction proceeds better with the lower rank coals, a large portion of the products is colloidal material. Treatment of coals with hot acidic phenol does not lead to their complete depolymerization. Treatment of Bruceton coal with refluxing phenol saturated with BF_3 also failed to give complete depolymerization. The formation of colloidal suspensions during investigations employing spectral and other physical measurements may lead to results that are susceptible to misinterpretation.

5696 **Mass spectrometry/mass spectrometry: capabilities and applications to fuel-related materials.** Ciupek, J.D.; Cooks, R.G.; Ferguson, C.R.; Wood, K.V. (Department of Chemistry, Purdue University, West Lafayette, IN 47907). *Fuel;* 62: No. 7, 829-834(Jul 1983). Contract FG22-81PC40780.

The expanding capabilities of mass spectrometry/mass spectrometry (m.s.-m.s.) in mixture analysis and its applications to fuel-related materials are illustrated. High and low collision energy m.s.-m.s data obtained on reverse geometry and triple quadrupole spectrometers are given for coal-derived liquid (SRC II) and diesel particulate samples. The direct analysis capability of the m.s.-m.s. methodology and its limitations are illustrated for the identification of an aliphatic carboxylic acid in diesel particulate. The selective ionization techniques of ammonia chemical ionization and negative chemical ionization are shown to be particularly useful in enhancing the specificity of m.s.-m.s. characterizations. Negative chemical ionization is used to confirm the presence of hydroxybenzoic acid in a diesel particulate sample. Combined laser desorption-chemical ionization is also demonstrated to be an effective ionization technique in m.s.-m.s. analysis. A variant of m.s.-m.s., in which selected anions fragment with charge inversion to give fragment cations, is also employed in the analysis of SRC II and used to identify thioaryl moieties. Functional group screening by an alternative m.s.-m.s. scan procedure,neutral loss scanning is demonstrated for phenols in SRC II. A scan for all parent ions of a selected daughter ion provides a screening procedure for rapidly identifying all compounds of a given structural type in a complex mixture. The dependence of m.s.-m.s. spectra on collision energy and pressure is shown to add further detail to m.s.-m.s. analysis. The development of a library of m.s.-m.s. spectra of reference compounds to be used for the identification of individual constituents in fuel-related materials is described.

0108 Waste Management

REFER ALSO TO CITATION(S) 6599

5697 **(CONF-8309166—6) Carbonaceous particles in coal combustion stack ash and their interaction with polycyclic aromatic hydrocarbons.** Griest, W.H.; Tomkins, B.A. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 11p. NTIS, PC A02/MF A01. Order Number DE84003272.

From 2. international conference on carbonaceous particles in the atmosphere; Linz, Austria (11 Sep 1983).

Carbonaceous particles consisting of uncombusted coal, coal coke, and intermediates are concentrated in the large particle size fractions (> 14 μm) of stack ash. Although they do not constitute a major portion of the ash, they appear to contribute significantly to the interaction of fly ash with organic matter. The carbonaceous particle-enriched fractions are more sorptive, have higher levels of organic matter, and exhibit higher specific surface areas than mineral or magnetic particle-enriched subfractions. Extraction recoveries of organics from fly ash appear to be limited mainly by the carbonaceous particles.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 5735, 5999

5698 **(DOE/OR/03054—75-Vol.1) Aquatic baseline studies of the Green River, Martin Creek, and Richland Slough, 1981-1982. Volume 1.** (International Coal Refining Co., Allentown, PA (USA)). Sep 1983. Contract AC05-78OR03054. 487p. NTIS, PC A21/MF A01. Order Number DE84004569.

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The purpose of the aquatic studies conducted by the Academy of Natural Sciences of Philadelphia (ANSP) was to complete the baseline study of a selected area of the Green River (Kentucky) and certain tributaries that began in 1977 (Southern Company Services, Inc., 1980). Particular emphasis was placed on the aquatic life in areas of the Green River that might be impacted by effluents discharged into the water and/or deposition from atomospheric discharges from the proposed International Coal Refining Company (ICRC) plant, and also a study of an area that in all probability would not be impacted is included. In addition to the ecosystem studies, certain chemical and physical studies were made to address the questions concerning the general characteristics of the water and how various chemicals that might be released by the ICRC plant would bioaccumulate and hence enter the food chain. Since the ICRC plant might affect downstream waters, particularly those retained in Lock and Dam No. 1, chemical studies to determine water quality and oxygen profile were made in this region. The bioaccumulation and the absorption of various heavy metals in fish and periphyton and the adsorption onto various sediments in the river were ascertained in samples from the various stations. The report is composed of 2 volumes. Volume I is divided into the following sections: introduction, ecosystem studies, ichthyoplankton studies, sediment studies, and chemical studies of the water column and periphyton, mussels, fish and sediments.

5699 **(DOE/OR/03054—75-Vol.2) Aquatic baseline studies of the Green River, Martin Creek, and Richland slough. Volume 2. Appendix.** (Academy of Natural Sciences of Philadelphia, PA (USA); International Coal Refining Co., Allentown, PA (USA)). Sep 1983. Contract AC05-78OR03054. 220p. NTIS, PC A10/MF A01. Order Number DE84004579.

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The purpose of the aquatic studies conducted by the Academy of Natural Sciences of Philadelphia (ANSP) was to complete the baseline study of a selected area of the Green River (Kentucky) and certain tributaries that began in 1977 (Southern Company Services, Inc., 1980). Particular emphasis was placed on the aquatic life in areas of the Green River that might be impacted by effluents discharged into the water and/or deposition from atmospheric discharges from the proposed International Coal Refining Company (ICRC) plant. This volume contains data on the taxonomy, species abundance, and productivity of the aquatic organisms sampled.

0110 Reserves And Exploration

REFER ALSO TO CITATION(S) 5721, 5740, 5980, 6730

5700 **(LA—9907-OBES) Mineral matter in peat: its occurrence, form, and distribution.** Raymond, R. Jr.; Andrejko, M.J. (eds.). (Los Alamos National Lab., NM (USA)). Oct 1983. Contract W-7405-ENG-36. 236p. (CONF-8309131—). NTIS, PC A11/MF A01. Order Number DE84002332.

From Mineral matter in peat workshop; Los Alamos, NM, USA (26 Sep 1983).

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To fully understand the mechanisms for mineral matter distribution and deposition within the original peat types and peat environments, a workshop was held on the occurrence, form, and distribution of mineral matter in peat. The goal was to share a variety of expertises, define areas of needed crucial research, develop new

lines of research, and above all, begin to communicate results. The workshop was divided into six sessions: (1) origin of and processes for mineral matter in peat; (2) mineral matter studies of cool climate peat deposits; (3) mineral matter studies of warmer, southeastern peat deposits; (4) sulfur in peat; (5) silica and silicates in peat; and (6) techniques and problems in peat analysis.

5701 (LA—9907-OBES, pp 3-24) **Origin of mineral matter in peat.** Andrejko, M.J.; Cohen, A.D.; Raymond, R. Jr. (Los Alamos National Lab., NM). Oct 1983. NTIS, PC A11/MF A01. (CONF-8309131—).

From Mineral matter in peat workshop; Los Alamos, NM, USA (26 Sep 1983).

The occurrence of mineral matter in peat is a function of several interrelated abiotic and biotic parameters. A better understanding of these parameters has been attained through the study of the mineral content of peats from the Okefenokee Swamp of Georgia, the Snuggedy Swamp of South Carolina, and the Everglades of Florida. Our results indicate that differences in mineral suites within peats result from differences in the local and regional geology, hydrology, geography, vegetational composition, and the depositional environment of the peat deposit. Additional results indicate that many minerals, once emplaced, may undergo alteration during the early stages of peat-accumulation. Thus, mineral matter in peat may be detrital (transported or reworked older sediments), authigenic (produced in situ), or diagenetic (altered) in origin. 54 references, 6 figures, 2 tables.

5702 (LA—9907-OBES, pp 25-38) **Biogenic silica in peats: possible source for chertification in lignites.** Andrejko, M.J.; Raymond, R. Jr.; Cohen, A.D. (Los Alamos National Lab., NM). Oct 1983. NTIS, PC A11/MF A01. (CONF-8309131—).

From Mineral matter in peat workshop; Los Alamos, NM, USA (26 Sep 1983).

The inorganic fraction of Okefenokee peats is primarily composed of detrital quartz and authigenic, biologically derived, amorphous silica (opal-A). The biogenic silica consists of sponge spicules, phytoliths, diatom frustules, and chrysomonad cysts. Many of the larger biogenic particles, such as sponge megascleres (spicules larger than 100 μm) and silicified bulliform cells (grass phytoliths larger than 40 μm), exhibit dissolution features of a possible bioerosional origin. These features are presumed to result from assimilative activities of micro-organisms such as bacteria, endolithic fungi, or diatoms. The observed features consist of both borings (distinct perforations 2 to 4 μm in diameter) and depressions (clustered, pit-like structures). The extremely delicate nature of eroded particles indicates that dissolution occurred within the site of deposition. Calculations suggest that interior peats of the Okefenokee are potentially substantial reservoirs of amorphous silica, and we suggest that the aforementioned degradation processes may play a significant role in silica dissolution and mobility in a peat-forming environment. The apparent lack of observed spicules and the occurrence of chert lenses in Tertiary lignites deposited under similar conditions to the Okefenokee peats might be a function of such bioerosional activities. 20 references, 6 figures.

5703 (LA—9907-OBES, pp 39-52) **Silicate minerals in organic-rich holocene deposits in southern Louisiana.** Bailey, A. (Univ. of Southwestern Louisiana, Lafayette); Kosters, E.C. Oct 1983. NTIS, PC A11/MF A01. (CONF-8309131—).

From Mineral matter in peat workshop; Los Alamos, NM, USA (26 Sep 1983).

Silicate minerals in low-temperature ashes from southern Louisiana organic-rich deposits and associated inorganic beds are being studied by x-ray diffraction and electron microscopy to better understand the origin of these minerals in coals. Exclusive of biogenic silica, most of the silicates appear to have been added to the peat deposits as water-transported detritus. These silicates are quartz and the clay minerals, smectites, kaolinite, and illite. Despite the apparent detrital origin for many of the silicates from organic-rich beds, compositions of low-temperature ashes from organic-rich samples differ from those of associated inorganic beds and between sites. At one site low-temperature ashes from organic-rich beds appear to have slightly more quartz than at the other site. Comparison of mineralogical compositions of typical coals with the compositions of these low-temperature ashes from organic-rich beds indicates that diagenetic changes take place to modify the initial basic mineralogical compositions. These include the following: loss of biogenic silica, transformation of smectites to illite, increase in crystallinity of kaolinite, and increase in the amount of kaolinite relative to quartz. 12 references, 7 figures.

5704 (LA—9907-OBES, pp 53-62) **Occurrence of calcium oxalate minerals within aquatic macrophytes from Okefenokee Swamp.** Bardin, S.W.; Bish, D.L. (Los Alamos National Lab., NM). Oct 1983. NTIS, PC A11/MF A01. (CONF-8309131—).

From Mineral matter in peat workshop; Los Alamos, NM, USA (26 Sep 1983).

Previous studies have determined the importance of some groups of plants in accumulating certain elements, such as silicon in members of the grass and sedge families, or metals in Nymphaea. Other work has determined that the various plant organs may differentially accumulate major elements. However, the extent of localization of these accumulations within actual plant organs and the possible mineral forms that may occur have not been studied to any great extent. Scanning electron microscopy, energy dispersive x-ray analysis and x-ray diffraction were used to determine the occurrence and mineral associations of major elemental accumulations in some important aquatic macrophytes. This study included such plants as Nymphaea, Orontium, and Taxodium, which are significant peat-forming plants in the Okefenokee Swamp of Georgia. Results from this study indicate that certain elements occur in distinct mineral forms, such as whewellite (calcium oxalate), within not only reference plant material but also in comparable, recognizable plant fragments of associated, surface peats. 10 references, 5 figures.

5705 (LA—9907-OBES, pp 63-76) **Variations in mineral matter content of a peat deposit in Maine resting on glaciomarine sediments.** Cameron, C.C.; Schruben, P. (Geological Survey, Reston, VA). Oct 1983. NTIS, PC A11/MF A01. (CONF-8309131—).

From Mineral matter in peat workshop; Los Alamos, NM, USA (26 Sep 1983).

The Great Heath, Washington County, Maine, is an excellent example of a multidomed ombrotrophic peatland resting on a gently undulating surface of glacio-marine sediments and towering above modern streams. A comprehensive study included preparation of a contoured surficial geology map on which are located 81 core sites. Eight cross sections show occurrence and thickness of three types of organic material and locations of cored sample analyses. The types include (1) basal marsh muck resting on glaciomarine silts and clays; this material has a mean moisture-free ash content of 57.4%; (2) hemic peat that has a mean moisture-free ash content of 4.9%; and (3) fibric peat that has a mean moisture-free ash content of 1.25%. Semiquantitative spectrographic analyses of the ash fractions of the cored samples provide data on 37 elements. Except for cadmium, amounts of which average highest in the fibric peat, amounts of each of the elements average lower in fibric peat than in hemic peat, and lower in hemic peat than in muck. The following interpretation is made: elements entered the system in the initial marsh stage of development, were stored in plant tissue during growth, and released during decay. Growth and decay were largely related to water movements during the rather complicated development of the ombrotrophic peatland. Ancient rather than modern hydrologic patterns are thus reflected. Today, the Great Heath contains an estimated resource potential of approximately 7,000,000 short tons of peat (dry basis). As a potential fuel, this peat has low-sulfur and high-hydrogen contents; Btu per pound ranges from 8500 to 10,000 with the hemic type having heating values above 9500. 8 references, 3 figures, 2 tables.

5706 (LA—9907-OBES, pp 77-86) **Use of models based on modern peat deposits to predict the distribution of mineral matter in coals.** Cohen, A.D.; Andrejko, M.J. (Los Alamos National Lab., NM). Oct 1983. NTIS, PC A11/MF A01. (CONF-8309131—).

From Mineral matter in peat workshop; Los Alamos, NM, USA (26 Sep 1983).

Numerous models have been proposed to define the depositional settings under which coals might have formed in the past.

The purpose of these models is to aid in predicting the compositional and mining characteristics of these coals. Our studies of modern peat deposits from Florida, Georgia, South Carolina, North Carolina, and Louisiana are providing us with data with which to both refine existing models and also to develop new models. This paper focuses on one aspect of our studies, the distribution of mineral matter in peats. Since most of our studies have been of intrashoreline, coastal plain peat deposits (e.g., Snuggedy Swamp, Okefenokee Swamp), our model for this type of setting is more precise than for any other type and, consequently, more readily used for predictive purposes in the ancient. 17 references, 2 figures, 1 table.

5707 (LA—9907-OBES, pp 87-112) **Occurrence and distribution of sulfur in peat-forming environments of southern Florida.** Cohen, A.D. (Los Alamos National Lab., NM); Spackman, W.; Dolsen, P. Oct 1983. NTIS, PC A11/MF A01. (CONF-8309131—).

From Mineral matter in peat workshop; Los Alamos, NM, USA (26 Sep 1983).

Cores and surface samples of peats from the Everglades-Mangrove region of southern Florida were analyzed for total sulfur and pyritic sulfur. These values were compared with the petrographic-botanical components of the peats as determined from point-counts of oriented microtome sections. Pyrite occurs as individual euhedral crystals, loosely packed framboids, and lenses or crusts of minute crystals. Framboids and minute crystals are often associated with organic matter and sometimes with bacteria and fungi. Pyrite tends to selectively occur in void spaces in or between peat tissues. In samples containing very small amounts of pyrite, framboidal pyrite is the prevalent form. Marine to brackish peats contain the highest pyrite and total sulfur contents, with brackish peats generally containing more pyrite than marine peats. Pyrite tends to be lower in all peats within 30 cm of the surface, whether marine or brackish. Burial of freshwater peats beneath marine or brackish peats tends to increase the total sulfur and pyritic sulfur in the underlying peats. Burial beneath brackish-water, clay-rich deposits (such as splays) tends to increase total sulfur and pyritic sulfur in the underlying deposits more than burial beneath less clay-rich deposits. 18 references, 9 figures, 8 tables.

5708 (LA—9907-OBES, pp 113-122) **Evidence from the Herrin No. 6 coal seam for pre- and post-burial differences in the sulfur and mineral contents of peat.** Crelling, J.C.; Stutzman, P.E.; Robinson, P.D. (Southern Illinois Univ., Carbondale). Oct 1983. NTIS, PC A11/MF A01. (CONF-8309131—).

From Mineral matter in peat workshop; Los Alamos, NM, USA (26 Sep 1983).

The Energy Shale is a nonmarine gray shale that occurs adjacent to a large fluvial deposit, the Walshville channel. It was deposited as a fire splay at the end of the deposition of the Herrin peat, which was later coalified into the Herrin No. 6 coal seam. Although it is well known that the total sulfur content of the Herrin No. 6 coal is higher under the marine rocks, the results of this study indicate that the marine influence is also associated with increases in the amount of both organic and inorganic sulfur and a greater variety and distribution of pyrite forms. The results of x-ray diffraction analysis show that the coal under the marine shale has less quartz, calcite, chlorite, and more pyrite than coal under the nonmarine rocks. All these results indicate that both the sulfur and mineral content of fresh peat can be significantly changed during the burial process and that the sulfur and mineral content of a given coal may not represent that of the original unburied peat. 14 references, 1 figure, 1 table.

5709 (LA—9907-OBES, pp 123-140) **Sulfur as a reflection of depositional environments in peats and coals.** Davies, T.D. (Exxon Production Research Co., Houston, TX); Raymond, R. Jr. Oct 1983. NTIS, PC A11/MF A01. (CONF-8309131—).

From Mineral matter in peat workshop; Los Alamos, NM, USA (26 Sep 1983).

Three discernible periods of sulfur emplacement in the peat/coal cycle were evident from studies of Recent peats from Florida Bay and high-volatile Middle Pennsylvanian bituminous coals from western Pennsylvanian (Lower Kittanning seam). The first period occurs during early stages of peat deposition when compaction is minimal and water circulation is unrestricted. During this time organic sulfur is emplaced, and depending upon the available sources of iron and sulfur, small euhedral crystals (0.5 to 15 μm) and framboids (5 to 50 μm) of pyrite may be incorporated within peats. If deposition occurs in a freshwater environment, organic sulfur will be low and pyrite may be absent; in a marine environment, the peat will have high organic sulfur content and may have high pyrite content depending upon available iron. The second period of sulfur emplacement occurs after peat deposition, but before coalification. If marine waters permeate a previously deposited peat, the organic sulfur content can increase and pyritic sulfur may also be augmented if iron is available. Because of the high permeability of peat, sulfur enhancement is greater in freshwater peat if it is overlain by marine peat than by marine carbonate mud. The third period occurs after coalification, when permeability is mostly restricted to joint or cleat fractures. At this stage organic sulfur content is not altered. If iron and sulfur are present in ground water, pyrite may be deposited, but only as fillings in fractures or pores. These pyrite fillings are distinguishable from the pyrite euhedral crystals and framboids formed during earlier stages. 24 references, 5 figures, 6 tables.

5710 (LA—9907-OBES, pp 141-146) **Comparison of some Florida peat deposits.** Gurr, T.M.; Luckett, M.A. (Dames & Moore, Lakeland, FL). Oct 1983. NTIS, PC A11/MF A01. (CONF-8309131—).

From Mineral matter in peat workshop; Los Alamos, NM, USA (26 Sep 1983).

Evaluation of Florida peat deposits for use as a fuel supply has generated considerable data on the quantity and quality of Florida peats. The available data include a range of peat deposits in both upland and lowland areas across Florida. The physiography was compared to fuel peat characteristics. Examination of the data did not reveal any significant correlation. 2 references, 1 figure, 1 table.

5711 (LA—9907-OBES, pp 159-168) **Occurrence of szomolnokite in Kentucky No. 14 coal and possible implications concerning formation of iron sulfides in peats and coals.** Raymond, R. Jr.; Bish, D.L.; Gooley, R. (Los Alamos National Lab., NM). Oct 1983. NTIS, PC A11/MF A01. (CONF-8309131—).

From Mineral matter in peat workshop; Los Alamos, NM, USA (26 Sep 1983).

Within the high-volatile bituminous Kentucky No. 14 coal from Hopkins County, Kentucky, alteration of iron disulfide (FeS_2) to szomolnokite occurred before exposure of the coal seam. Szomolnokite is the only hydrated iron sulfate in the sample, is as abundant as pyrite, and with the pyrite constitutes more than 90% of the 10.5 wt % mineral matter present. Marcasite is present as a lesser constituent. Szomolnokite is not restricted to the surface but has replaced FeS_2 throughout the sample. Replacement occurred as a result of water permeating through the coal seam. Szomolnokite preferentially replaced void-filling FeS_2, leaving crystallites of framboidal pyrite floating in an iron-sulfate matrix, resembling salt on a street vendor's pretzel. We suggest the void-filling FeS_2 was less stable, possibly as a result of low pH conditions at the time of its deposition as suggested by others, and that conditions in the Kentucky No. 14 were ideal for its preferential replacement. 13 references, 2 figures.

5712 (LA—9907-OBES, pp 179-188) **Selected trace element anomalies in a front range bog, Larimer County, Colorado.** Sarnecki, J.C. (Exxon Coal Resources USA, Inc., Houston, TX). Oct 1983. NTIS, PC A11/MF A01. (CONF-8309131—).

From Mineral matter in peat workshop; Los Alamos, NM, USA (26 Sep 1983).

Selected trace element anomalies in a bog in Larimer County, Colorado, can be attributed to differences in peat humification, vegetation types, and depositional environments. The peat bog is a reed-sedge type with a slightly raised dome and is about 10 acres (4 hectares) in size with up to 15 ft (4.6 m) of organic sediments. The surface vegetation is dominated by Carex, Salix, and Betula in three zones: (1) tall shrubs, (2) small shrubs, and (3) nonshrubs. Organic matter was initially deposited as clayey, algal

muck during a morraine-blocked pond stage. Beaver dams maintained pond levels until sedges closed off the open water. During the succeeding bog stage, high-quality, reed-sedge peat was deposited over the pond sediments. Samples were taken from various stratigraphic horizons at sites in the small shrub and the nonshrub zones. Results of analyses show that leaching has influenced the stratigraphic position of all of the elements studied, including lead and thorium. More copper, molybdenum, nickel, and zinc were accumulated by plants in the shrub zone than in the nonshrub zone in the upper bog horizon. Molybdenum and uranium were most strongly adsorbed by peats in the lower, more humified horizons of the bog deposit. Ground water moving through the peat strongly promoted leaching and provided a new source of trace elements. The uranium content in this Larimer County bog is unusually high and may indicate a local economic source. 7 references, 4 figures, 3 tables.

5713 (LA—9907-OBES, pp 189-198) **Source and origin of the mineralogy of the northern Florida Everglades.** Sawyer, R.K. (Texaco, Offshore Exploration, New Orleans, LA); Griffin, G.M. Oct 1983. NTIS, PC A11/MF A01. (CONF-8309131—).

From Mineral matter in peat workshop; Los Alamos, NM, USA (26 Sep 1983).

The Florida Everglades peat deposits infill an ancient limestone drainage channel that occupies almost 3 million acres in South Florida. Approximately 833 organic soil cores were taken in the Palm Beach County area of the Everglades, in 1981. From these cores, 65 samples of peat, muck, sapropel, and underlying marl and limestone were analyzed for mineral type and relative percent using x-ray analysis and scanning electron microscopy. Nonorganic material in freshwater sediments was the result of two general source areas, having been transported into the Everglades basin from surrounding topographic highs (allochthonous origin). The allochthonous group was composed of calcite, quartz, feldspar, and the clay minerals montmorillonite, palygorskite, sepiolite, illite, chlorite, and kaolinite. Autochthonous mineralogy was composed exclusively of the calcium oxalate mineral weddellite. Peat samples located along the flanks of the Everglades Basin, directly over limestone bedrock, or immediately south of Lake Okeechobee showed an abundance of allochthonous minerals. Peat samples located away from allochthonous mineral input areas contained almost 100% weddellite. The autochthonous mineral weddellite was derived from internal mineral precipitation during the life processes of peat-forming vegetation and retained in the Everglades during the slow plant decay process. 4 references, 4 figures, 1 table.

5714 (LA—9907-OBES, pp 215-224) **Preservation of dolomite in coastal peats of the Ten Thousand Islands area, Florida.** Upchurch, S.B. (Univ. of South Florida, Tampa); Strom, R.N.; Williams, M.J. Oct 1983. NTIS, PC A11/MF A01. (CONF-8309131—).

From Mineral matter in peat workshop; Los Alamos, NM, USA (26 Sep 1983).

Silt-sized dolomite rhombohedra are common detrital components of the coastal, mangrove peats of the Ten Thousand Islands. They increase in abundance seaward and are introduced into the coastal swamps from the sea by tidal flooding and storm surges. The clasts vary in degree of preservation from undamaged or slightly mechanically abraided clasts in peats closest to the Gulf of Mexico to clasts that are heavily pitted by dissolution in the more continentally influenced environments. They are not preserved in peaty sands at the landward fringe of the swamp. The peats and associated sediments range from reducing to slightly oxidizing and have pH's from 6.7 to 8.2. Calculations of saturation indices, assuming no organic-cation complexing, indicate that associated waters are undersaturated with respect to aragonite and calcite, but strongly oversaturated with respect to dolomite. An attempt to approximate the amount of organic complexing of calcium and magnesium by comparison of electrometric and spectrophotometric analysis suggests that organic complexing of calcium and magnesium is important in the low-salinity peat-forming environments and becomes less important seaward. Thus, preservation of dolomite in peats may be an indicator of proximity to the sea and importance of organic complexing. 7 references, 4 figures.

5715 (LA—9907-OBES, pp 225-236) **Model for silicification in peat-forming environments.** Upchurch, S.B. (Univ. of South Florida, Tampa); Strom, R.N.; Andrejko, M.J. Oct 1983. NTIS, PC A11/MF A01. (CONF-8309131—).

From Mineral matter in peat workshop; Los Alamos, NM, USA (26 Sep 1983).

Silicification of peats is a relatively rare phenomenon, even though there is much evidence to suggest that many organisms metabolize significant silica in peat-forming environments. The fabrics of silicified peats and other organic-rich sediments can be used to reconstruct portions of the diagenetic history of the sediment and the nature of the silica flux through the decomposing organic matter. The fabrics reflect a combination of three groups of processes: silica flux rate, poisoning of silica polymers by impurities, and pH variations. Peats seem to moderate the silica flux rate and pH through organic complexing and buffering. Where organics are available as impurities, diagnostic fabrics may result. 45 references, 2 figures.

5716 (USGS-OFR—81-597) **Geology and chemical analyses of coal, Mesaverde Group (Cretaceous), Lower White River coal field, Moffat and Rio Blanco Counties, Colorado.** Hildebrand, R.T.; Garrigues, R.S. (Geological Survey, Denver, CO (USA)). 1981. 27p. USGS Open File Service, Box 25425-Denver Fed Ctr, Denver, CO 80225.

The Lower White River coal field comprises an area of approximately 930 square miles underlain by coal-bearing strata in Moffat and Rio Blanco Counties, northwestern Colorado (Landis, 1959; Hornbaker and others, 1976). The field lies along the northwestern edge of the Piceance Creek basin near the Utah border. Significant coal deposits in the Lower White River field occur in the Mesaverda Group of Late Cretaceous age; original resources are estimated to be as much as 11,763 million short tons to a depth of 6000 feet (Hornbaker and others, 1976). A total of 13 samples of coal (10 core samples and 3 samples of drill cuttings) were collected from five drill holes in the northwestern part of the Lower White River field during exploratory drilling conducted by the US Geological Survey in 1976 (see Garrigues, 1976; Barnum and others, 1977). These samples represent several coal beds in the middle part of the Mesaverde Group. Table 1 gives brief descriptions of the samples; the general geology of the area and sample localities are shown in figure 2.

0120 Mining

5717 (NP—4770054) **Dust abatement in shield supports by means of extraction and precipitation of the fine dust in the gaps between shields.** Oden, U. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Fakultaet fuer Bergbau, Huettenwesen und Maschinenwesen). 26 Jun 1981. 143p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84770054.

Shield supports are used in coal mines all over the world. The shielding of the face area is not sufficient, however, and dust will be raised especially when the shields are moved. The resulting dust loads often exceed the maximum permissible values, so that dust abatement measures are necessary. Spraying with water and extraction are methods to reduce the amount of fine dust. The fundamentals of the extraction process are presented.

5718 (NP—4770055) **Establishment of a rock burst criterion for coal mining by means of a finite difference method.** Schaepermeier, E. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Bauingenieur- und Vermessungswesen). 7 May 1979. 121p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84770055.

Rock bursts in coal mines are a serious hazard for mining operations. The author investigates the combinations of geometric mining conditions and limiting loads near the face that may cause certain compensating rock movements, as well as the types of compensating movement that may occur. The investigation will help to find out criteria for rock burst hazards.

5719 **(NP—4770056) Safety measures in a region of high rock pressure at Schlaegel and Eisen mine.** Schedlbauer, L. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen). 20 Nov 1980. 193p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84770056.

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Mining in deeper horizons raises complex problems of roadway support measures. For various reasons, the internal diameter should be enlarged. On the other hand, the higher rock pressure in greater depths will reduce the roadway diameter. Disturbances of operation must be defined and remedied systematically, observing the laws of rock mechanics as well as the measured effects of mining operations.

5720 **(NP—4770057) Basic study for optimisation of the performance of selective cut heading machines with transverse cutters.** Wiese, H.F. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Fakultaet fuer Bergbau, Huettenwesen und Maschinenwesen). 22 Jan 1982. 131p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84770057.

With 13 tabs.

Bit wear is a major cost factor. Some bits are subject to heavy wear while others are hardly affected even in long-term operation. To facilitate planning of inspection and maintenance schedules, the wear rate of all bits should be constant. Improvements in cutting efficiency are discussed, and a method of calculation is presented to supplement the empirical methods of construction of a transverse cutter head.

5721 **(NP—4770059) Directional adjustment and control of long drill strings in horizontal drilling in Rhenish-Westphalian coal mines.** Bernauer, M. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Fakultaet fuer Bergbau, Huettenwesen und Maschinenwesen). 12 Feb 1982. 215p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84770059.

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The author investigates the technical posisibilities of directional control in borehole drilling, both in the vertical and horizontal plane.

5722 **(NP—4770060) Reduction of dynamic loads on the plough chain.** Dill, W. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen). 18 Dec 1980. 159p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84770060.

In West German coal mines, coal ploughs are used, in general, for winning in thin seams. The output can be increased by means of high-load chains. The author investigates constructional measures to reduce the loads on the plough chain and thus achieve coal ploughs of lighter weight.

5723 **(USGS-OFR—80-955) Reconnaissance of water availability and quality in abandoned coal mines near Roslyn, Kittitas County, Washington.** Packard, F.A. (Geological Survey, Tacoma, WA (USA)). 1981. 25p. USGS Open File Service, Box 25425-Denver Fed Ctr, Denver, CO 80225.

The recoverable volume of ground water in abandoned coal mines near Roslyn, Washington is estimated to be 20,000 acre-feet. During times of drought, pumping this water into the Cle Elum and Yakima Rivers for use in irrigation downstream should present few major water-quality problems. Wells at seven locations should be sufficient to withdraw the recoverable water from nine separate reservoirs within the mines. Under normal recharge (precipitation) conditions, these reservoirs would refill in about 6 years. 14 references, 5 figures, 3 tables.

5724 **Coal mine electrotechnology.** Cooley, W.L. (ed.). Morgantown, WV; West Virginia University (1982). 428p. (CONF-820782—).

From 6. WVU conference on coal mine electrotechnology; Morgantown, WV, USA (28 Jul 1982).

A conference is presented which deals with electrical technology in mining. Particular emphasis is placed on coal mining. Twenty-seven papers are included in the conference, of which twenty-four have been abstracted and indexed for the Energy Data Base. The papers deal with mine power systems, mine communications, safety systems, automation and control, safety devices and instrumentation, and monitoring. (JMT)

0130 Transport And Handling

5725 **(ANL/ER-TM—83-2) Network programming system for studying coal transportation.** Tobin, R.L. (Argonne National Lab., IL (USA)). Oct 1983. Contract W-31-109-ENG-38. 26p. NTIS, PC A03/MF A01. Order Number DE84003303.

This paper describes a network programming/data management system developed for the study of coal transportation. At the heart of the system is a freight transportation model that considers the decisions of both the shippers (e.g., coal buyers) and the carriers (rail and barge operators). This model functions primarily in a predictive mode, selecting appropriate coal sources, transportation modes, and transportation routes that minimize the delivered price of coal to each coal user. Congestion at locks and on rail lines can be predicted because the model can also account for the movements of all other commodities on the rail and waterway system. The system framework is flexible in that it includes software and data bases that allow the user to easily define study regions of any size (sub-state to whole nation) and to specify different levels of transportation network detail within the study region. This allows for a completely detailed transportation network in the region of interest while modeling important movements into and out of the region on an aggregate network. This keeps the network programming problems to a reasonable size without sacrifice of detail where needed. The system was conceived as a management decision tool for the Office of Fuels Conversion, Economic Regulatory Administration, US Department of Energy. It has been used to study the cumulative transportation impacts of switching 42 powerplants in the northeastern United States from oil or natural gas to coal and in a similar study of switching 14 powerplants in Florida from oil to coal. 7 references, 11 figures, 2 tables.

5726 **(DOE/CS/15041—T1) Foulke process. Final report.** (Fluid Coal Corp., Wilmington, DE (USA)). 15 Sep 1983. Contract FG01-81CS15041. 12p. NTIS, PC A02/MF A01. Order Number DE84003654.

Fluid Coal Corporation has prepared this report on the Foulke Process in accord with the provisions of US Department of Energy Grant No. DE-FG01-81CS15041 awarded June 14, 1981. The purpose of the grant was to explore feasibility of the Foulke Process for use in preparation of coal-oil mixtures. Experimental results show that substitution of hot oil for water in coal cleaning can produce substantial improvements in ash removal. The use of hot oil is at least as effective in the removal of sulfur as is the use of water. Although the research was limited to only one coal sample (Upper Freeport, Preston County, West Virginia), the research provides evidence that the Foulke Process as potential commercial value in coal preparation. Based on these favorable results, this report recommends that the research study be expanded to include: wider variety of coal samples, so that more accurate estimates can be made of the effectiveness of the Foulke Process in relation to conventional coal cleaning methods; use of intermediate scale cleaning equipment, larger than the laboratory hydrocyclones used in this study, but smaller than the equipment used commercially for coal cleaning; and an economic evaluation of the Foulke Process for use in large-scale coal cleaning operations.

5727 **(DOE/PC/30212—T5) Venturi design for metering solids flow in gas-solids suspensions. Final report.** Crowe, C.T. (Washington State Univ., Pullman (USA). Dept. of Mechanical Engineering). 1 Dec 1982. Contract FG22-80PC30212. 108p. NTIS, PC A06/MF A01. Order Number DE84001030.

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The utility of venturimeters to meter the flow rate of gas-solids suspensions was investigated. The data show that the pressure drop between the pipe and throat varies linearly with solids

mass flow rate at a given gas mass flow rate. The slope of this curve, which is related to the pressure ratio parameter, provides a measure of sensitivty of venturimeter to loading (solids/gas mass flow ratio). The conclusions of the test program can be summarized as follows: (1) there is no benefit in venturi performance to be gained by using reduced approach angles; (2) the optimum venturi configuration yields higher pressure ratio parameters than the conventional venturi at the same flow conditions; (3) the annular configuration performs similarly to the conventional venturi but can be located as close as 5 diameters from an upstream disturbance with no noticeable deterioration in performance; (4) the particle size distribution cannot be correlated with mass median diameter or Sauter mean diameter. The characteristic particle size probably depends on Stokes number; (5) a measurement of laser attenuation through the throat section of the venturi can be used to calculate loading provided particle size is known; and (6) total head loss across a venturi does not show a marked increase with loading. There is no advantage to be gained in head loss reduction by using exit cone angles as small as 2°. Comparable performance is achievable with the standard 8° exit cone. 3 references, 19 figures.

5728 **(DOE/PC/51006—T1) Dynamic mathematical model and computer simulation of a generic power plant coal pulverizing system.** Baurle, J.W. (Drexel Univ., Philadelphia, PA (USA). Coll. of Engineering). May 1981. Contract AC22-82PC51006. 69p. NTIS, PC A04/MF A01. Order Number DE84000506.

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In order to provide a facility to verify analytically derived control schemes of power plants operating under emergency conditions, it became necessary to develop a mathematical model of a generic power plant that would reflect the dynamics associated with emergency operation. With this purpose in mind, the mode developed in this thesis is a component in a total power plant model. A first principle approach in modeling is used, that is the model is developed by appropriately applying the physical laws that describe the processes. The mathematical model has been programmed and executed using a higher level FORTRAN program called Digital Simulation Language, thus providing a digital simulation of the pulverizing system. Graphs produced by the simulation are included and constitute the results of this thesis. 6 references, 15 figures, 14 tables.

0140 Combustion

5729 **(DOE/FC—1022) Conventional pulverized coal and fluidized bed combustion testing of San Miguel lignite.** Jones, M.L.; Goblirsch, G.M. (North Dakota Univ., Grand Forks (USA). Energy Research Center). 1982. 16p. (CONF-821176—3). NTIS, PC A02/MF A01. Order Number DE84003012.

From International conference on combustion of tomorrow's fuels; Santa Barbara, CA, USA (8 Nov 1982).

The information generated at GFETC can be summarized in the following way: (1) The ash fouling furnace is an empirical tool which provides good information on relative fouling potential of various fuels. In the case of San Miguel lignite, tests suggest a severe fouling problem if conventional boiler designs are employed. (2) No effect in either deposition rate or deposit strength was seen when MgO and $CaCO_3$ were used as additives. For these tests a single addition rate was utilized at two different injection points in the system. (3) Deposits from the combustion of San Miguel lignite are very different from those observed when burning a Northern Great Plains lignite, primarily because of the building of deposits from the refractory wall. (4) No bed agglomeration was noted under the varied run conditions used in AFBC testing of this lignite fuel. (5) The AFBC NO/sub chi/ level emitted in the flue gas were always less than the NSPS limit of 0.6 lbs $NO_2/10^6$ Btu. (6) Utilization of inherent alkali was less than that observed for North Dakota lignites. It was possible to meet NSPS standards of 90% sulfur capture using limestone addition. Use of lower grade fuels such as the lignite from the San Miguel mine is inevitable if we are to meet the expanding needs for energy in the United States today. To make use of these different fuels extensive testing on laboratory and pilot scales will be beneficial in avoiding major problems due to the different characteristics these materials possess. The present successful operation of a full scale boiler using the San Miguel lignite is a good example of the value pilot scale studies can have on the road to successful operation.

5730 **(DOE/PC/30300—8) Particulate processes in pulverized coal flames. Final technical report, 15 September 1980-15 February 1983.** Wuerer, J.E.; Henze, R.H.; Azzazy, M. (Spectron Development Labs., Inc., Costa Mesa, CA (USA)). Feb 1983. Contract AC22-80PC30300. 129p. NTIS, PC A07/MF A01. Order Number DE84003527.

This report describes the results of an experimental program to investigate the physical aspects of pulverized coal combustion. Emphasis was placed upon the study of the following physical processes: devolatilization, soot formation and burnout, and char burnout and flyash formation. The program had three major elements, namely: (a) dilute particle devolatilization experiments, (b) all coal flame devolatilization experiments, and (c) dilute particle burnout and flyash events. The principal experimental variables were: coal type, particle size, local gas phase stoichiometry, and residence time. Two coal types were used in the investigation; a high volatile A bituminous coal and a lignite coal. Extensive use of pulsed laser holography was made to allow the nonintrusive observation of the physical processes of interest. Over 700 reconstructed holographic images representative of these events are presented. Multi-color optical pyrometry was utilized to make particle temperature measurements. 18 references, 61 figures, 5 tables.

5731 **Upper wall slag deposits in utility boilers: a progress report on recent work.** Austin, L.G.; Abbott, M.F.; Kinneman, W.P. (Department of Mineral Engineering and Fuel Science Section, The Pennsylvania State University, University Park, PA). *American Society of Mechanical Engineers, [Paper]*; No. 83-JPGC-PWR-42, 8(1983). (CONF-830905—). Contract FG22-80PC30199.

From Joint power generation conference; Indianapolis, IN, USA (25 Sep 1983).

This paper reviews the major conclusions from a study of slag drop adhesion to boiler steel substrates under conditions comparable to upper wall deposits in utility boiler furnaces. Several different types of test strongly suggest that there is at least one type of bad-acting fly ash particle which initiates slag deposit build-up in the cooler upper regions of a furnace. Fly ash particles formed from coal particles with the correct mixture of pyrite and glass-forming components such as clay and quartz remain fluid and sticky at relatively low temperatures and wet and adhere strongly to the oxide layers on boiler steel. The role of condensed alkali layers in this process has not yet been elucidated. This initiating layer acts as a base for attachment of sticky fly ash spheres.

5732 **Energy/exergy analysis of pressurized fluidized bed combustor.** Ghamerian, A.; Cambel, A.B. (Exxon Research and Engineering Co., Florham Park, NJ). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 1: 323-327(Aug 1982). (CONF-820814—). Contract FG01-78ET12308.

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

A combined-cycle pressurized fluidized bed combustor with steam turbine and gas turbine generating units is considered by invoking First (energy) and Second (exergy) analysis. Energy and exergy flow diagrams are presented. It is noted that exergy analysis provides insights that may be helpful in optimizing system components.

5733 **Coal water fuel: a technology update.** Marnell, P.; Krishna, C.R. (Brookhaven Nat'l Laboratory, Upton, NY). *Energy Technology (Washington, D.C.);* 9: 855-862(Jun 1982). (CONF-820217—).

From 9. energy technology conference; Washington, DC, USA (16 Feb 1982).

The ash, fuel form, and combustion characteristics of coal prevents its direct use in the vast amount of combustion equipment. Coal gasification, liquefaction and clean coal-water fuel try to develop a clean fluid fuel from coal. Coal water fuel (CWF) has been demonstrated in Germany and the USSR. In Germany, it was found that 60/40 coal water could be prepared with conventional

wet cement grinding technology, could be stored by using mechanical stirrers, and readily burned in an existing utility boiler. A coal water Fuel Technology Workshop at Brookhaven in 1981 drew up a list of objectives. A DOE program is tasked to research fuel characteristics, combustion characterization, equipment selection, and boiler testing. In the future, an effective mineral removal process must be developed.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 6026

0160 Health And Safety

REFER ALSO TO CITATION(S) 5681, 5717, 5718

5734 (CONF-8205230—Summ., pp 86) **Mutagenicity and carcinogenicity tests of products and wastes from fossil fuels.** Guerin, M.R. (Oak Ridge National Lab., TN). Sep 1983. NTIS, PC A09/MF A01.

From Conference on establishment of a bioassay system for cancer risk assessment in energy technology; Baltimore, MD, USA (3 May 1982).

The biohazards associated with liquefaction and gasification of coals, the liquefaction of oil shales, fluidized bed combustion, and diesel fuel utilization have been addressed. The urgency of estimating the biological hazard associated with a multitude of novel technologies required the simultaneous application of existing bioassay methods, validation of those methods, and development of more suitable methods. Samples from coal combustion and petroleum processing were tested along with those from the advanced technologies to provide a comparative measure of biological potency. Cancer risk has been addressed by studies of the bacterial mutagenicity and mouse skin carcinogenicity of samples derived from the new fossil fuels technologies. The gross potency of the samples has been determined by biotesting the crude samples. Alkaline and polar-substituted neutral polycyclic aromatic components of the materials are found responsible for the bacterial mutagenicity of petroleum substitutes. Polycyclic aromatic hydrocarbons and their neutral nitrogen and analogues appear to be primarily responsible for the mouse skin carcinogenicity of petroleum substitutes. Coal-derived products tend to exhibit greater mutagenicity and carcinogenicity than do shale-derived products. Both petroleum substitutes exhibit greater mutagenicities and carcinogenicities than do their petroleum equivalents. Bioactivity is found to increase with increasing boiling range and to decrease with increasingly severe hydrotreatment.

5735 (ORNL/TM—8905) **Life sciences synthetic fuels. Semiannual progress report for the period ending June 30, 1983.** Cowser, K.E. (Oak Ridge National Lab., TN (USA)). Nov 1983. Contract W-7405-ENG-26. 58p. NTIS, PC A04/MF A01. Order Number DE84004572.

This document describes the results of environmental and health studies of synthetic fuels conducted from January to June 1983. Activities reported cover not only research performed for the Department of Energy (DOE) Office of Health and Environmental Research (OHER), but also progress made in studies sponsored by DOE Fossil Energy. The latter studies are identified in the text. The report includes program elements identified with either a specific technology or comparative generic research activities. In Section 3, the studies at the University of Minnesota-Duluth (UMD) gasifier are described, which involve primarily the documentation of results. Other parts of our activities, concerned with new health and safety initiatives at the Westinghouse fluid bed gasifier process development unit (PDU) and at the Texaco Inc. entrained flow gasifier PDU, are also presented. Results are reported in Section 4 on the characterization and biological testing of process and plant area samples collected during previous sampling campaigns at the H-Coal pilot plant. Finally, generic research activities concerned with the environmental and health evaluation of products, by-products, effluents, and upgraded product materials from fossil energy technologies are described in Section 5.

0170 Legislation And Regulations

5736 (NP—4900402) **Texas lignite technology development priorities over the next twenty-five years.** White, D.M. (Texas Governor's Energy Advisory Council, Austin (USA)). 15 Mar 1979. 23p. NTIS, PC A02/MF A01. Order Number DE84900402.

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The following conclusions were stated: Essentially all future use of Texas lignite will be accomplished through the use of four technologies: pulverized coal combustion, atmospheric fluidized bed combustion, medium Btu gasification and in situ gasification. The bulk of lignite use over the next twenty-five years is expected to occur in the electric utility industry through the use of existing pulverized coal technology. Of the remaining three technologies, atmospheric fluidized bed combustion has the greatest potential energy impact. Major constraints to its commercial use are technical and economic uncertainties regarding its scale-up to utility size operations and unproven reliability. The development of medium Btu gasification depends significantly on pricing policies for and supplies of natural gas. The major market for medium Btu gas will be in the state's industrial coastal zone. Technologies for the recovery of deep basin lignite will become increasingly important after 1990. However, current knowledge of these processes are inadequate to estimate the potential for their successful development. Environmental control research with regard to air emissions and solid waste deserve further attention. Development of lignite beneficiation technologies may be important as an alternative to total reliance on stack gas controls.

02 PETROLEUM

REFER ALSO TO CITATION(S) 7078

0202 Geology And Exploration

REFER ALSO TO CITATION(S) 5763

5737 (TENRAC/EDF—087) **Geological characterization of Texas oil reservoirs. Final report.** Galloway, W.E.; Garrett, C.M. Jr.; Tyler, N.; Ewing, T.E.; Posey, J.S. (Texas Univ., Austin (USA). Bureau of Economic Geology). 31 Aug 1982. 107p. NTIS, PC A06/MF A01. Order Number DE84900417.

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This report documents the results of the first year of a two-year examination of the geologic and engineering attributes of the major oil-producing reservoirs of Texas. The goals of year one of this program include: (1) Collect, collate, and synthesize geologic, engineering, and production data on major Texas oil reservoirs. Reservoirs that have produced more than 10 million barrels of oil were included in the initial data base. (2) Develop geologically related familes of reservoirs, called plays. A hydrocarbon play is a group of geologically related fields having basically the same source-reservoir-trap controls. Primary groupings are by similar reservoir genetic facies. Further subdivision is usually by trap type. (3) Using data from files of the Texas Railroad Commission and other public sources, characterize each defined oil play in terms of: (a) recoverable reserves, (b) volume of in-place oil, (c) petrophysical properties of the reservoir, (d) trapping mechanism, (e) fluid properties, (f) drive mechanism, (g) reservoir management practices and conventional well spacing, and (h) calculated oil recovery efficiency. (4) Select those plays which, because of their large volume of in-place oil, low recovery efficiencies, and favorable reservoir and fluid properties, are primary coandidates for more detailed geologic and engineering analysis. Such candidate plays are the targets for significant improvement of ultimate production. (5) Evaluate comparative recovery efficiency as a function of well spacing. (6) Accomplish a preliminary examination of the utility of generic reservoir facies models in prediction of reservoir compartmentalization and heterogeneity, and thus as predictors of reservoir performance. 8 figures, 4 tables.

5738 **(TENRAC/EDF—105) Geological characterization of Texas oil reservoirs. Biennial report, September 1, 1981-August 31, 1983.** Galloway, W.E.; Tyler, N.; Garrett, C.M. Jr.; Bebout, D.G.; Cheng, E.S.; Fisher, W.L. (Texas Univ., Austin (USA). Bureau of Economic Geology). 1983. 91p. NTIS, PC A05/MF A01. Order Number DE84900434.

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Approximately 153 billion barrels of in-place oil have been discovered in Texas reservoirs. Assuming recovery efficiency continues to increase modestly, an estimated 61 billion barrels of this oil will be produced, largely by conventional primary and secondary recovery technologies. The remaining 90 plus billion barrels of oil represent a target of immense proportions. For comparison, most recent estimates by the US Geological Survey are that only 6 to 22 billion barrels of additional recoverable oil are likely to be found by continued exploration in the State. Certainly not all of this unproduced oil can be recovered. Simple arithmetic shows that about one-fourth of the unrecovered 90 to 100 million barrels must remain in portions of the reservoirs that have not been drained in the course of conventional field development. Such oil is trapped in isolated compartments or lenses that were not tapped by wells drilled on conventional, regular spacings. Thus it constitutes a potential target for selective infield exploration and drilling. The objectives of this study were (1) to examine the geology and development history of the entire population of Texas oil reservoirs, (2) to improve our estimate of the amount of oil that remains as a target for strategic infield exploration and development; (3) to identify families of oil fields that offer the greatest potential for significantly improving statewide recovery efficiency by application of such infill programs; and (4) develop generic reservoir models that might be applied to improving recovery from the important families of less efficient reservoirs. 27 references, 21 figures, 5 tables.

5739 **(USGS-OFR—82-391) Temperatures and interval geothermal-gradient determinations from wells in National Petroleum Reserve in Alaska.** Blanchard, D.C.; Tailleur, I.L. (Geological Survey, Menlo Park, CA (USA)). [nd]. 82p. NTIS, PC A05/MF A01. Order Number DE84900478.

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Temperature and related records from 28 wells in the National Petroleum Reserve in Alaska (NPRA) although somewhat constrained from accuracy by data gathering methods, extrapolate to undisturbed formation temperatures at specific depths below permafrost, and lead to calculated geothermal graidents between these depths. Tabulation of the results show that extrapolated undisturbed temperatures range from a minimum of 98°F (37°C) at 4000 feet (1220 m) to a maximum of 420°F (216°C) at 20,260 feet (6177 m) and that geothermal gradients range from 0.34°F/100' (6°C/km) between 4470 feet to 7975 feet (Lisburne No. 1) and 3.15°F/100' (57°C/km) between 6830 feet to 7940 feet (Drew Point No. 1). Essential information needed for extrapolations consists of: time-sequential bottom-hole temperatures during wire-line logging of intermediate and deep intervals of the borehole; the times that circulating drilling fluids had disturbed the formations; and the subsequent times that non-circulating drilling fluids had been in contact with the formation. In several wells presumed near direct measures of rock temperatures recorded from formation fluids recovered by drill stem tests (DST) across thin (approx. 10-20 foot) intervals are made available. We believe that the results approach actual values close enough to serve as approximations of the thermal regimes in appropriate future investigations. Continuous temperature logs obtained at the start and end of final logging operations, conductivity measurements, and relatively long-term measurements of the recovery from disturbance at shallow depths in many of the wells will permit refinements of our values and provide determination of temperatures at other depths. 4 references, 6 figures, 3 tables.

5740 **(USGS-OFR—82-714) Assessment of the petroleum, coal, and geothermal resources of the economic community of West African states (ECOWAS) region.** Mattick, R.E. (comp.). (Geological Survey, Denver, CO (USA)). 1982. 87p. USGS Open File Service, Box 25425-Denver Fed Ctr, Denver, CO 80225.

Approximately 85 percent of the land area of the ECOWAS (Economic Community of West African States) region is covered by basement rocks (igneous and highly metamorphosed rocks) or relatively thin layers of Paleozoic, Upper Precambrian, and Continental Intercalaire sedimentary rocks. These areas have little or no petroleum potential. The ECOWAS region can be divided into 13 sedimentary basins on the basis of analysis of the geologic framework of Africa. These 13 basins can be further grouped into 8 categories on the basis of similarities in stratigraphy, geologic history, and probable hydrocarbon potential. The author has attempted to summarize the petroleum potential within the geologic framework of the region. The coal discoveries can be summarized as follows: the Carboniferous section in the Niger Basin; the Paleocene-Maestrichtian, Maestrichtian, and Eocene sections in the Niger Delta and Benin; the Maestrichtian section in the Senegal Basin; and the Pleistocene section in Sierra Leone. The only proved commercial deposits are the Paleocene-Maestrichtian and Maestrichtian subbituminous coal beds of the Niger Delta. Some of the lignite deposits of the Niger Delta and Senegal Basin, however, may be exploitable in the future. Published literature contains limited data on heat-flow values in the ECOWAS region. It is inferred, however, from the few values available and the regional geology that the development of geothermal resources, in general, would be uneconomical. Exceptions may include a geopressured zone in the Niger Delta and areas of recent tectonic activity in the Benue Trough and Cameroon. Development of the latter areas under present economic conditions is not feasible.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 5737, 5738, 5997

5741 **(DOE/BC/10116—12) Measurement of interfacial tension.** Manning, C.D.; Pesheck, C.V.; Puig, J.E.; Seeto, Y. (Minnesota Univ., Minneapolis (USA). Dept. of Chemical Engineering and Materials Science). Nov 1983. Contract AS19-78BC20002. 169p. NTIS, PC A08/MF A01. Order Number DE84003522.

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This report draws together a sequence of researches that today stand as a cornerstone of the University of Minnesota program on the fundamentals of enhancing petroleum recovery. At the core of these researches are ultralow interfacial tensions: tensions of millidynes per centimeter or less (micronewtons per meter or less). The sequence of systematic researches into the measurement of ultralow interfacial tensions opened two doors. The first is the door to understanding the mechanisms by which surfactant-based chemical flooding processes can enhance petroleum recovery. Paramount among these mechanisms is the reduction of interfacial tension between crude oil and oilfield brine to ultralow values so that capillarity is not able to conspire with irrepressible porespace geometry to hold captive large amounts of oil, residual oil as it is known. The second door that opened was to understanding the mechanisms by which surfactant-based formulations achieve ultralow tensions between hydrocarbon and water, or between crude oil and oilfield brine. The report consists of the following four chapters: (1) comparison of sessile, pendant, and spinning-drop method of measuring ultralow interfacial tensions; (2) on the approach of a spinning drop to gyrostatic equilibrium; (3) improved spinning-drop instrument and technique for low interfacial tension; and (4) interfacial tension measurements in three-phase systems - ultra low tensions. 115 references, 57 figures.

5742 **(DOE/BC/10640—21) Computer simulation of recovery of heavy crude oil using carbon dioxide drive or huff-n-puff. Final report.** Begin, R.; Krueger, D.A. (Colorado State Univ., Fort Collins (USA). Dept. of Physics). Nov 1983. Contract AS19-81BC10640. 108p. NTIS, PC A06/MF A01. Order Number DE84002484.

This study is limited to an investigation of the behavior of the flows in and near a fracture. The numerical model simulates multicomponent, multiphase, compressible flow through a horizontal two-dimensional porous medium which is bounded on one side by a one-dimensional fracture. The absolute permeability of the fracture is assumed to be much greater than that of the reservoir matrix, resulting in the simplification that flow in the matrix is predominately perpendicular to the fracture face. Flow in the matrix parallel to the fracture is ignored in this model. The fluid system

consists of three components in three phases. Component 1 is the injected fluid, e.g., CO_2, and can exist in any of the three phases - gas, oil, and water. Component 2 is the hydrocarbon component and is assumed to be heavy enough so that it exists only in the oil phase. Component 3 is the aqueous component and is restricted to the water phase. All fluid properties, except viscosity and relative permeability, are assumed to be linear functions of pressure and composition. The temperature of the system is taken as constant and effects due to capillary pressure and gravity are not included. The mathematical formulation is based on a set of molar continuity equations (one per component), the phase equilibrium condition, and a volume conservation equation. Reduction of this system of equations to a single equation in pressure leads to a sequential (implicit pressure-explicit moles) method of solution. In-step iterations are performed to increase the implicitness of the method. The algorithm includes time step control and a volume balance check. A flow chart of the computer code as well as the source code and input and output formats are included in the Appendix. Three sample problems are examined. 20 references, 6 figures, 2 tables.

5743 **(DOE/BETC—1395-6) Residual oil saturation determination. Wilmington micellar-polymer project. Final report.** Staub, H.L. (Long Beach City Dept. of Oil Properties, CA (USA)). Oct 1983. Contract AC03-77ET12044. 77p. NTIS, PC A05/MF A01. Order Number DE84003431.

The City of Long Beach, California conducted a program to obtain residual oil saturation (ROS) data in the HX/sub a/ Sand, Fault Block VB, Wilmington Field. This program utilized many complementary techniques for determining the ROS in a watered-out unconsolidated sand, typical of many reservoirs in the California Coastal Province. This program was to be performed in two stages. The first, Phase 1, was intended to determine the ROS in an area which had been flooded out during the course of a peripheral waterflood and to make a comparative analysis of current methods for determination of in-situ oil in place. The second stage, Phase 2 of the ROS program, was intended to measure the ROS after tertiary recovery by a micellar-polymer flood; however, the second phase was not carried out for lack of funds. This report describes the diagnostic tools and techniques which have been used to establish ROS. It then presents a comparative analysis of the results obtained using the different techniques. Inasmuch as the determination of in-situ oil saturation is directly dependent upon the in-situ value for porosity, it is required that the pore volume as a fraction of the reservoir rock be determined before the residual oil equation can be solved. Because of this, much of the study necessarily was concerned with measurement of porosity of the unconsolidated sand. The method finally used to obtain a very good core recovery in this highly unconsolidated sand is described. Present oil saturation and oil content of the HX/sub a/ sand in the Pilot is now believed to be better defined. This conclusion is supported by results obtained for electrical log analysis, analysis of full sized native state cores run under stress conditions, plug core analysis under stressed conditions and a Single-Well Tracer Survey. 15 references, 18 figures, 16 tables.

5744 **(DOE/MC/10689—17) Development of mobility control methods to improve oil recovery by CO_2. Final report.** Heller, J.P.; Taber, J.J. (New Mexico Inst. of Mining and Technology, Socorro (USA). New Mexico Petroleum Recovery Research Center). Nov 1983. Contract AC21-79MC10689. 94p. NTIS, PC A05/MF A01. Order Number DE84002852.

In certain reservoir situations, highly compressed carbon dioxide has a great advantage over more common fluids as a displacement agent to force crude oil from the porous rock in which it's found. The advantage is that a much higher microscopic efficiency can be attained in the displacement process - at least in the laboratory. This research aims to relieve a major difficulty that has so far prevented this high efficiency from being reached in field applications. The difficulty is that because CO_2 is much less viscous than oil or water, the injected fluid does not displace the oil uniformly. Instead, the CO_2 moves faster in some regions and directions than others, and viscous fingers are formed, through which most of the injected fluid flows. Some of these breakthrough into the production wells, lowering the effectivenesss of both the injected CO_2 and of the production pumping capacity. The aims of this project has been to develop ways to thicken the injected CO_2, so as to forestall the growth of these parasitic flow patterns and the premature breakthrough that results from them. Two ways of thickening CO_2 have been investigated. Substantial progress has been made in both developments and both are promising. The first of the methods studied considers the use of polymer dissolved in the dense CO_2 to increase its viscosity by the needed extent. The second method to thicken the injected CO_2 is to combine it with aqueous surfactant solution in a CO_2 foam. The second of these methods is much nearer to field use than the other, particularly in lower temperature reservoirs. Work in this project has covered many details of the development of these thickening methods and has also considered the means by which they might be applied in the oilfield.

5745 **(TENRAC/EDF—085-Vol.2B) Onshore impacts of offshore oil and gas activities: coastal impact assessment. Volume 2-B. Final report.** (Rice Center, Houston, TX (USA)). Feb 1983. 369p. NTIS, PC A16/MF A01. Order Number DE84900425.

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5746 **Decision analysis of the appropriate R and D strategy for enhanced oil recovery (EOR).** Nesbitt, D.M.; Phillips, R.L. (Decision Focus Inc., Los Altos, CA). *Energy Systems and Policy;* 7: No. 3, 235-259(1983).

This paper describes a decision analysis of the appropriate level of national aggregate research and development expenditure on Enhanced Oil Recovery (EOR) R and D. The analysis concludes that under the assumptions used a high level of R and D effort on EOR R and D is justified. The analysis also suggests that larger EOR R and D programs entail less overall economic risk than smaller programs by serving as a hedge against high world oil prices. The work was sponsored by DOE, with special credit to Lewin and Associates and DFI. 7 references, 8 figures, 7 tables.

5747 **Formation of middle-phase microemulsions using surfactants derived from a renewable resource: ethoxylated tall oils.** Magid, L.J. (Oak Ridge National Lab, TN). *Journal of Colloid and Interface Science;* 87: No. 2, 447-459(Jun 1982). Contract W-7405-ENG-26.

The range of salinities over which a large number of multicomponent systems containing ethoxylated tall oils or tall-oil derivatives form middle-phase microemulsions was determined. n-Octane and n-decane were used as the hydrocarbons; 2 methyl-1-propanol and 2-butanol as the cosurfactants. It is possible, with an appropriate choice of surfactant, to produce systems with optimal salinities from 0 to ca. 17 wt% NaCl. Phase volume diagrams are presented for 24 of the systems investigated; interfacial tension measurements for selected systems show tensions in the millidyn/cm range at the optimal salinities.

0206 Health And Safety

REFER ALSO TO CITATION(S) 5681

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 5753, 5997, 6018, 6026

5748 **(DOE/CS/50007—1-Vol.2-App.) Impacts of alcohol fuels on the US refining industry. Volume 2. Appendices. DOE Alcohol Fuel Programs; Alternative Fuels Utilization Program.** Dickson, J.C.; Frederick, F.P.; Sipowicz, W.W. (Bonner and Moore Management Science, Houston, TX (USA)). Aug 1983. Contract AC01-81CS50007. 187p. NTIS, PC A09/MF A01. Order Number DE84003358.

This volume contains 11 appendices. Data and discussions are presented under the headings: refined products demand forecasts; petrochemical demand forecasts; highway fuels detail forecast; crude slate development; refined product inspections; regional refining output requirements; residual fuels breakout by sulfur content; volatility blending values for alcohols; health and safety study; detailed results from regional LP model and refinery simulation

studies; as-used 1990 crude supply and product demands. 3 figures, 92 tables. (DMC)

5749 **(DOE/EIA—0109(83/11)) Petroleum supply monthly, November 1983.** (USDOE Energy Information Administration, Washington, DC). 23 Nov 1983. 83p. NTIS, PC A05/MF A01 - GPO. Order Number DE84003005.

Background data relating to Liquefied Petroleum Gas (LPG) are discussed. International developments, US trends, and EIA's projections for the near future and the longer term are included. This article is supplemented by some common LPG terminology and a simplified diagram illustrating the flow between LPG sources and processing stages.

5750 **(DOE/EIA—0380(83/11)) Petroleum marketing monthly.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Nov 1983. 105p. NTIS, PC A06/MF A01 - GPO. Order Number DE84004852.

Information and statistical data about a variety of petroleum products, including motor gasoline, distillates, residuals, jet fuel, kerosene, and propane are presented. Petroleum products sales statistics for use by industry, government, and private sector analysts, educational institutions, and consumers are given.

5751 **(DOE/IG—0201) Audit of the petroleum pricing violation escrow account.** (Department of Energy, Washington, DC (USA). Office of Inspector General). 16 Dec 1983. 14p. TIC, PO Bx 62, Oak Ridge, TN 37831.

Report to the Secretary.

An audit was conducted to determine whether (1) internal accounting and administrative controls over the escrow account were adequate to ensure that payments due into the account were collected and properly accounted for, and (2) detailed written plans exist to expedite proper distribution of escrow account funds. Violations were noted where ERA had (1) not accrued or collected interest on installment payments as required in some consent orders; (2) not provided for explicit interest on installment account balances and on some negotiated orders; and (3) not charged or collected interest on delinquent payments. A statistical estimate indicated that the account was understated by $3.7 million in unaccrued interest due on installment account balances and an additional $543,000 in unaccrued interest on the balances of delinquent accounts. Implementation of a proposed plan for distribution of funds in the escrow account should prove satisfactory for proper disbursement of escrow funds. Recommendations were that the deficient interest be identified and procedures be implemented to assure proper future collection; that interest be explicitly identified in all future consent orders allowing payment through installment. Administrator comments are included. (PSB)

5752 **(NP—4770065) Figures from the petroleum economy.** (Deutsche BP Benzin und Petroleum A.G., Hamburg (Germany, F.R.). Informationsabteilung). 1982. 84p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84770065.

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The brochure 'Figures from the mineral oil economy' published by the Deutsche BP Aktiengesellschaft (Inc.) presents statistical informations about reserves, production, longhand transport and processing of raw petroleum in the Federal Republic of Germany and in some cases in the world. The consumption, storage and distribution of mineral oil products, the total of motor vehicles and the prices and taxes for motor fuels are indicated also. The primary and end energy consumption of the Federal Republic of Germany is distributed according to different energy sources.

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 6609, 6610, 6611

0210 Legislation And Regulation

REFER ALSO TO CITATION(S) 5751

5753 **(GAO/NSIAD—83-69) Pros and cons of exporting Alaskan North Slope oil.** (General Accounting Office, Washington, DC (USA). National Security and International Affairs Div.). 26 Sep 1983. 33p. US General Accounting Office, Document Handling and Information Services Facility, P.O. Box 6015, Gaithersburg, MD 20760.

Report to the Chairman, Subcommittee on International Economic Policy and Trade, Committee on Foreign Affairs House of Representative.

US laws restrict the export of oil produced from Alaska's North Slope fields. Whether some of that oil should now be exported is a subject of debate. The controversy involves complex political and economic matters which affect the oil and maritime industries, government revenues, national security, and international relations. In this report, GAO presents the major perceived advantages and disadvantages of exporting Alaskan North Slope oil.

5754 **(NP—4900389) New protection for public investors in oil and gas drilling funds.** Ventura, J.E. (Texas Governor's Energy Advisory Council, Austin (USA)). 8 Apr 1976. 5p. NTIS, PC A02/MF A01. Order Number DE84900389.

The State Securities Board has adopted Administrative Guidelines for Registration of Oil and Gas Funds Programs which were constructed for a three-fold purpose - one of which is to assure public investors of adequate capitalization of the sponsor (the entity which originates and promotes an oil program) to perform the ventures to be shared fairly between the investors and sponsors. This paper presents a synopsis of the rules of the Securities Board which would be applicable to the employment of a joint-vent to raise drilling funds.

0230 Properties

5755 **(LBL—16867) Molecular characterization and fingerprinting of vanadyl porphyrin and non-porphyrin compounds in the asphaltenes of heavy crude petroleums using HPLC-GFAA analysis.** Wines, B.K.; Vermeulen, T.; Fish, R.H. (Lawrence Berkeley Lab., CA (USA)). Aug 1983. Contract AC03-76SF00098. 140p. NTIS, PC A07/MF A01. Order Number DE84004967.

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High performance liquid chromatography coupled with graphite furnace atomic absorption (HPLC-GFAA) analysis were used to study the precipitated asphaltene fraction of four heavy crude petroleums. Prudhoe Bay and Wilmington crude oils from Alaska and California, respectively, have low vanadium and asphaltene concentrations. Boscan and Cerro Negro are Venezuelan crudes with high levels of vanadium and asphaltenes. The emphasis of this study is the molecular characterization of classes of vanadyl compounds, with special emphasis placed on differentiating the locations of non-porphyrin and porphyrin compounds in the HPLC-GFAA analyses of the asphaltenes and their solvent extracts. Steric exclusion chromatography (SEC) columns were used to determine the molecular weight distribution of vanadium in the asphaltenes and extracts. Fingerprints obtained from SEC-HPLC-GFAA analysis of asphaltenes or normal and reverse phase HPLC-GFAA analysis of polar extracts provided information on the composition of the asphaltines. 122 references, 27 figures, 7 tables.

5756 **Formation of middle-phase microemulsions in multicomponent systems containing petrostep-465 and ethoxylated tall oils.** Magid, L.J. (Oak Ridge National Lab., TN). *Journal of Colloid and Interface Science;* **87**: No. 2, 460-468(Jun 1982). Contract W-7405-ENG-26.

The range of salinities over which certain Petrostep-465/ethoxylated tall oil/cosurfactant/hydrocarbon/brine systems form middle-phase microemulsions was determined. The presence of the nonionic surfactant, in cases where n-decane is the hydrocarbon and 2-butanol is the cosurfactant, increases the optimal salinity of the system. Some broadening of the salinity range over which low interfacial tensions are observed is also found. Phase behavior for systems containing P-465 as the only surfactant shows order of mixing effects.

0240 Storage

REFER ALSO TO CITATION(S) 5980, 6028

0250 Combustion

REFER ALSO TO CITATION(S) 5760

03 NATURAL GAS

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 5763

5757 **(N—8327310) Study of LANDSAT-D thematic mapper performance as applied to hydrocarbon exploration.** Everett, J.R. (Earth Satellite Corp., Chevy Chase, MD (USA)). Apr 1983. 31p. (E—83-10325; NASA-CR—170383). NTIS, PC A03/MF A01.

Improved delineation of known oil and gas fields in southern Ontario and a spectacularly high amount of structural information on the Owl Creek, Wyoming scene were obtained from analysis of TM data. The use of hue, saturation, and value image processing techniques on a Death Valley, California scene permitted direct comparison of TM processed imagery with existing 1:250,000 scale geological maps of the area and revealed small outcrops of Tertiary volcanic material overlying Paleozoic sections. Analysis of TM data over Lawton, Oklahoma suggests that the reducing chemical environment associated with hydrocarbon seepage change ferric iron to soluble ferrous iron, allowing it to be leached. Results of the band selection algorithm show a suprising consistency, with the 1,4,5 combination selected as optimal in most cases.

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 5745, 5997

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 5752, 5997, 6018, 6026

5758 **(NP—4900398) Preliminary analysis of new Federal Power Commission price ceilings on interstate natural gas: production, employment and tax impacts on the Texas economy. Report No. 76-09-01.** Holloway, M.L.; Stevens, M. (Texas Governor's Energy Advisory Council, Austin (USA)). 3 Sep 1976. 9p. NTIS, PC A02/MF A01. Order Number DE84900398.

Both short-term and long-term impacts are analyzed. Actual and forecasted usage of natural gas are tabulated for 1972 through 1979, with a few projections through 1985. (PSB)

5759 **(NP—4900399) Natural gas decontrol study: supporting materials.** (Government Printing Office, Washington, DC (USA)). Apr 1976. 29p. NTIS, PC A03/MF A01. Order Number DE84900399.

0310 Legislation And Regulation

REFER ALSO TO CITATION(S) 5754

0340 Combustion

5760 **(DOE/PC/30195—1) Investigation of soot formation characteristics of alternative liquid fuels in spray flames. Final technical report.** Sangiovanni, J.J. (United Technologies Research Center, East Hartford, CT (USA)). Aug 1983. Contract AC22-80PC30195. 117p. NTIS, PC A06/MF A01. Order Number DE84004558.

Portions are illegible in microfiche products. Original copy available until stock is exhausted.

Through a series of well-controlled droplet combustion experiments, the soot formation characteristics of alternative liquid fuels in spray flames were investigated. To simulate a wide range of practical conditions for spray flames, the test matrix included four (4) model fuels, three (3) coal-derived synthetic liquid fuels, three (3) ambient conditions (temperature and oxygen concentration), three (3) interdroplet spacings, and three (3) droplet residence times. A specially-developed electrostatic probe was used to separate and extract samples of liquid droplets and gas phase soot from the spray flames. The physical and chemical properties of the various samples of soot particles and partially burned fuels were then studied to provide an improved understanding of the dominant physical and chemical processes which govern soot formation in spray flames. Analyses of samples of partially burned liquid fuels by gas chromatography indicate that liquid phase chemical processes do not occur in light fuel oils, such as No. 2 fuel oil, during droplet combustion. No conclusions, however, could be made about similar changes in the chemical composition of heavy distillate fuel oils during combustion. Studies of the morphology of soot samples by transmission electron microscopy show clearly that the growth of soot particles in spray flames is extremely rapid. However, when the individual soot spheroids reach a mean diameter of about 250 A to 350 A they cease growing. Possible explanations for these soot particle growth trends are proposed. Elemental analyses indicate that the carbon-to-hydrogen atomic ratio of soot varies with residence time in the flame from about 12:1 to 8:1. Identification of the hydrocarbon functional group composition of the soot by infrared absorption spectroscopy shows a corresponding shift in the hydrogen containing molecules from aliphatic to aromatic structures as the soot ages. 21 references, 16 figures, 3 tables.

04 OIL SHALES AND TAR SANDS

0401 Reserves And Exploration

REFER ALSO TO CITATION(S) 5757, 5763

0404 Oil Production, Recovery, And Refining

5761 **(SAND—83-2103) Oil shale program. Twenty-ninth and thirtieth quarterly reports, January 1983-June 1983.** Hommert, P.J. (ed.). (Sandia National Labs., Albuquerque, NM (USA)). Nov 1983. Contract AC04-76DP00789. 77p. NTIS, PC A05/MF A01. Order Number DE84003600.

The overall efficiency of in-situ shale oil recovery processes is determined principally by a combination of sweep efficiency, retorting efficiency and volumetric efficiency. These individual efficiency components are related to the way in which the retort bed is prepared, the retorting process and the structural characteristics of the mine and in situ retorts. Four single borehole cratering shots were performed during this period at the Anvil Points mine. Two were systems checkout tests. The other two constituted the first tests called for in the Joint Rock Fragmentation Experiment Plan. These two tests were identical except that in one case stemming above the explosive charge was not used. Preliminary results indicate similar amounts of rubblization between the two shots. Advances in the computational treatment of rock motion were made

during this period. The BUMF codes were used to investigate asymmetric blast effects observed on the SAI D-3 shot. The BLOCKS code was utilized to simulate rock motion for 550 ms in a cratering geometry. Analysis of the core taken from Geokinetics Retort 23 is presented. An initial series of laboratory experiments that investigate the effects of permeability contrast on retort yield were completed. These unique experiments demonstrated that permeability contrasts can cause yield losses. A tracer experiment indicated that in order for tracers to be useful in detecting non-uniformities in a rubble bed the distance between sample points cannot be much larger than the size of the non-uniform region.

0405 Properties And Composition

REFER ALSO TO CITATION(S) 6285

0407 Health And Safety

REFER ALSO TO CITATION(S) 5681, 5734

0409 Waste Research And Management

5762 **(LA—9801-PR) Assessment and control of water contamination associated with shale oil extraction and processing. Progress report, October 1, 1980-September 30, 1982.** Peterson, E.J.; Henicksman, A.V.; Nyitray, A.M.; O'Rourke, J.A.; Wagner, P. (Los Alamos National Lab., NM (USA)). Jul 1983. Contract W-7405-ENG-36. 37p. NTIS, PC A03/MF A01. Order Number DE84003565.

Los Alamos National Laboratory's research on the assessment and control of water contamination from commercial oil shale operations is concerned with the elucidation of water contamination problems and the subsequent evaluation of alternative control strategies for mitigating oil-shale-related water degradation. Laboratory assessment activities have focused on the interaction of the raw material and the process variables and their influence on the ultimate identity and behavior of the spent shale, the resultant leachates, and the chemistry of other aqueous effluents. To develop a perspective of the health and environmental consequences of oil shale processing, we must understand the identity and behavior of the raw material, the fundamental chemical principles operative during processing, and the interaction of the raw material and the process to yield products, effluents, and wastes. This report summarizes experimental results, including the mineralogy, trace element concentrations in solids and leaching characteristics of raw and spent shales from field- and laboratory-generated materials; the implications for water quality also are discussed. Control technology research activities involve the identification and research of alternative control strategies based on control technology requirements defined by assessment activities. The chemistry elucidated during the assessment activities is used to formulate appropriate strategies to mitigate identified problems. Experimental activities focus on two inexpensive control measures, process control and multistage leaching, to prevent adverse impacts on ground water quality after retort abandonment. Although conservative control strategies may be necessary for some situations, they probably do not need to be used routinely. The current state of process water treatment, reuse options, and codisposal options also are addressed.

0410 Enviromental Aspects

REFER ALSO TO CITATION(S) 5762

05 NUCLEAR FUELS

0501 Reserves

5763 **Western Slope Colorado.** Epis, R.C.; Callender, J.F. (eds.). Socorro, NM; New Mexico Geological Society, Inc. (1981). 337p. (CONF-8110216—).

From 32. New Mexico Geological Society field conference; Grand Junction, CO, USA (8 Oct 1981).

A conference on the geology and geologic resources of the Western Slope of western Colorado and eastern Utah is presented. Fourteen papers from the conference have been abstracted and indexed for the Department of Energy's Energy Data Base. These papers covered such topics as uranium resources, oil shale deposits, coal resources, oil and gas resources, and geothermal resources of the area. (JMT)

0502 Exploration

REFER ALSO TO CITATION(S) 5763, 5959

5764 **(GJBX—16(83)) National Uranium Resource Evaluation. General procedure for calibration and reduction of aerial gamma-ray measurements: specification BFEC 1250-B.** Purvance, D.; Novak, E. (Bendix Field Engineering Corp., Grand Junction, CO (USA)). Dec 1983. Contract AC13-76GJ01664. 48p. NTIS, PC A03/MF A01. Order Number DE84004974.

The information contained in this specification was acquired over the course of the US Department of Energy (DOE) National Uranium Resource Evaluation (NURE) program during the period 1974 through 1982. NURE was a program of the DOE Grand Junction Area Office to acquire and compile geologic and other information with which to assess the magnitude and distribution of uranium resources and to determine areas favorable for the occurrence of uranium in the United States. Bendix Field Engineering Corporation (BFEC) has been the operating contractor for the DOE Grand Junction facility. The requirements stipulated herein had been incorporated as contractual specifications for the various subcontractors engaged in the aerial gamma-ray surveys, which were a major aspect of the NURE program. Although this phase of NURE activities has been completed, there exists valuable knowledge gained from these years of experience in the calibration of gamma-ray spectrometer systems and in the reduction of calibration data. Specification BFEC 1250-B is being open-filed by the US Department of Energy at this time to make this knowledge available to those desiring to apply gamma-ray spectrometry to other geophysical problems.

5765 **(GJBX—41(83)) Systems manual for National Uranium Resource Evaluation: system specifications.** (Oklahoma Univ., Norman (USA). Energy Resources Inst.). 30 Sep 1983. Contract AC13-82GJ01706. 259p. NTIS, PC A12. Order Number DE84003471.

Paper copy only, copy does not permit microfiche production.

This System Specifications document describes the system used to create a computerized master file containing sample analyses collected by the National Uranium Resource Evaluation Hydrogeochemical and Stream Sediment Reconnaissance Program.

5766 **(GJBX—42(83)) National Uranium Resources Evaluation. Final report, April 1, 1982-September 30, 1983.** (Oklahoma Univ., Norman (USA). Energy Resources Inst.). Oct 1983. Contract AC13-82GJ01706. 45p. NTIS, PC A03. Order Number DE84003470.

Paper copy only, copy does not permit microfiche production.

Information Systems Programs of the Energy Resources Institute at the University of Oklahoma designed and created for the Department of Energy a computerized master file containing 995,792 sample analyses collected by the National Uranium Resource Evaluation (NURE) Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) program. This report describes the processing of the NURE data which took place between April 1, 1982, and September 30, 1983. In general, the work included: (1) the performance of extensive systems analysis to review the different data formats in which the data were available; (2) the design of a composite record description incorporating and combining, where possible, all data elements and codes defined in the different formats; and (3) the computer processing required to convert the data to GIPSY format, accomplish conversion, plus insert data quality assessment statements developed by the Grand Junction area office.

5767 **(INIS-mf—8258) Optimizing the exploration programme on the basis of a geological concept for the genesis of the uranium deposit in the Lichtental Depression zone.** Mueller, H. (Technische Univ. Berlin (Germany, F.R.). Fachbereich Bergbau und Geowissenschaften). 9 Nov 1981. 185p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE83704624.

Thesis.

Combined with the results obtained by sinking wells, we could draw lines of identical uranium concentrations and thus gained information about the mineralisation zones. The systematic conditions of alluvial fan sedimentation are distinctly discernible. Together with the mineralisation fluctuations in the raise 2/1-2 representative deposit portions can be defined, whose explorational well-known state is described by the degree of exploration, which indicates the relation between the existing and the required exposures. Thus a possibility is provided to evaluate and assess the required exposure expenses in relation to the reserves in restricted deposit portions. The optimisation of the exploration programme results from the continuous comparison between the required and the existing exposures.

5768 **(INIS-mf—8594) South Greenland uranium exploration programme. Final report.** Armour-Brown, A.; Tukiainen, T.; Wallin, B. (Groenlands Geologiske Undersoegelse, Copenhagen (Denmark)). Nov 1982. 131p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE83704625.

Contains 26 maps.

This is the final report of the reconnaissance phase of the SYDURAN Project which was initiated in 1st. December 1978 to outline areas of increased uranium potential where more detailed prospection would be warranted. Districts and smaller zones in South Greenland which have the potential for containing economically exploitable uranium occurrences were defined using airborne gamma-spectroscopic, reconnaissance geochemical and geological methods. Other districts and areas have been shown to have no uranium potential and can be eliminated. The three promising districts are: 1. a 2000 square kilometre sub-circular district surrounding Ilimaussaq complex in which there are small high grade pitchblende occurences in faults and fractures in the surrounding granite. 2. the eastern area of the Motzfeldt Centre where large parts of the centre is mineralised and may give rise to exploitable, large tonnage, low grade uranium ore with associated niobium and rare earth elements in extractable quantities. 3. uraniferous rich districts or zones associated with the migmatitic supracrustal units in the area between Kap Farvel and Lindenows Fjord. The areas which were eliminated from having any uranium potential include: the Ketilidian supracrustal unit. the Nunarssuit alkaline complex. The uranium mineralisation in South Greenland is confined to two Proterozoic episodes: a) a late phase of granitisation and migmatisation with the formation of disseminated uraninite in the Migmatite Complex in the south of the project area between 1700-1800 m.y. and, b) hydrothermal activity associated with Gardar magmatic events between 1090-1170 m.y. in the central Granite Zone. Future work should be directed towards the definition and location of drilling targets. (EG).

5769 **(USGS-OFR—82-983) Potential for uranium deposits in the Tertiary Kootznahoo Formation of the southern part of the Admiralty trough, southeastern Alaska.** Dickinson, K.A.; Campbell, J.A. (Geological Survey, Denver, CO (USA)). 1982. 20p. USGS Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225.

The Kootznahoo Formation is potentially an excellent host rock for uranium. It includes permeable sandstone and conglomerate beds together with suitable reductants. Carbonaceous fragments are common in some of the sandstone and conglomerate beds and pyrite is present in a coal bed. Slight epigenetic uranium enrichment is present in some of the conglomerate and sandstone beds and possibly in the coal bed. Surface oxidation would probably have destroyed any surficial uranium deposits, but deposits could be found in subsurface reduced zones. The Kootznahoo is overlain by volcanic rock that includes dacite and rhyolite that have abnormally high uranium content in some places. The Th/U ratio of the few samples analyzed, however, suggests that these potential source rocks have not lost uranium by leaching. A potential for uranium deposits cannot be ruled out, however, because uranium leaching may have occurred from the same rock in other areas or from other rocks and because there must have been a source of uranium for the occurrence found in the northern part of the Admiralty trough. 18 references, 5 figures, 5 tables.

0503 Mining

REFER ALSO TO CITATION(S) 5806

0504 Feed Processing

REFER ALSO TO CITATION(S) 5806

5770 (INIS-mf—8536, pp 77) **Identification and elimination of substances that interferes with the purification of Mexican uranium concentrates.** Jimenez-Reyes, M. (Instituto Nacional de Investigaciones Nucleares, Mexico City). 1982. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).

Published in summary form only.

5771 **Automatic instrumental chemical analysis in uranium processing plants.** Tamizi, M. Canterbury, England; Kent University (1982). 636p. British Library, Boston Spa, Wetherby, West Yorks. No. D44035/82.

Thesis.

The manuscript consists of three distinct sections dealing with (a) a detailed review of developments in uranium hydrometallurgy, (b) an extensive investigation of the application of manual and automatic analytical techniques to control aspects of Amex (Purlex) plants, and finally (c) a fundamental study of the equilibria leading to the distribution of uranium (VI) between an acidic sulphate solution and the organic solutions of the most used commercially tertiary amine (TOA) in the processing of uranium ores. A large part of the present research program was devoted to a thorough study of the problem associated with a desire to monitor uranium (VI) in various process streams of amine solvent extraction plants.

0505 Enrichment

REFER ALSO TO CITATION(S) 5810, 5821, 6097

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 5814, 5822, 5975, 5979

5772 **(HEDL-SA—2881-FP) Automated system for loading nuclear fuel pins.** Marshall, J.L. (Hanford Engineering Development Lab., Richland, WA (USA)). Oct 1983. Contract AC06-76FF02170. 5p. (CONF-831047—114). NTIS, PC A02/MF A01. Order Number DE84003812.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

A completely automatic and remotely controlled fuel pin fabrication system is being designed by the Westinghouse Hanford Company. The Pin Operations System will produce fuel pins for the Fast Flux Test Facility (FFTF) and the Clinch River Breeder Reactor Plant (CRBRP). The system will assemble fuel pin components into cladding tubes in a controlled environment. After fuel loading, the pins are filled with helium, the tag gas capsules are inserted, and the top end cap welded. Following welding, the pins are surveyed to assure they are free of contamination and then the pins are helium leak tested.

5773 **(HEDL-SA—2891-FP) SAF line furnace operations.** Gerber, E.W.; Bowen, W.W.; Williams, J.A. (Westinghouse Hanford Co., Richland, WA (USA)). Oct 1983. Contract AC06-76FF02170. 4p. (CONF-831047—115). NTIS, PC A02/MF A01. Order Number DE84003771.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

The Secure Automated Fabrication (SAF) line incorporates three different furnace operations, all of which are automated and remotely controlled. The debinding furnace operation removes organic material from the pressed pellets prior to sintering, the sintering furnace operation densifies the pellets and the off-line property adjustment furnace removes excess gases after sintering.

5774 **(HEDL-SA—2894-FP) SAF line powder operations.** Frederickson, J.R.; Horgos, R.M. (Westinghouse Hanford Co., Richland, WA (USA)). Oct 1983. Contract AC06-76FF02170. 5p. (CONF-831047—117). NTIS, PC A02/MF A01. Order Number DE84003769.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

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An automated nuclear fuel fabrication line is being designed for installation in the Fuels and Materials Examination Facility (FMEF) near Richland, Washington. The fabrication line will consist of seven major process systems: Receiving and Powder Preparation; Powder Conditioning; Pressing and Boat Loading; Debinding, Sintering, and Property Adjustment; Boat Transport; Pellet Inspection and Finishing; and Pin Operations. Fuel powder processing through pellet pressing will be discussed in this paper.

5775 **(HEDL-SA—2900-FP) Instrumentation and control system for an automated fuel fabrication process.** Anderson, D.L.; Frick, D.C.; Hoitink, N.C. (Westinghouse Hanford Co., Richland, WA (USA)). Oct 1983. Contract AC06-76FF02170. 5p. (CONF-831047—116). NTIS, PC A02/MF A01. Order Number DE84003768.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

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A computer-based distributed control system planned for the Secure Automated Fabrication (SAF) fuel fabrication line is described. The control system provides both local and remote control options.

5776 **(HEDL-SA—2901-FP) SAF line analytical chemistry system.** Gerber, E.W.; Sherrell, D.L. (Westinghouse Hanford Co., Richland, WA (USA)). Oct 1983. Contract AC06-76FF02170. 6p. (CONF-831047—118). NTIS, PC A02/MF A01. Order Number DE84003773.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

An analytical chemistry system dedicated to supporting the Secure Automated Fabrication (SAF) line is discussed. Several analyses are required prior to the fuel pellets being loaded into cladding tubes to assure certification requirements will be met. These analyses, which will take less than 15 minutes, are described. The automated sample transport system which will be used to move pellets from the fabriction line to the chemistry area is also described.

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 5789, 5807, 5812, 5819, 5820, 5823, 5824

5777 **(DP—1663) Colorimetric determination of reducing normality in the Purex process.** Baumann, E.W. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Jul 1983. Contract AC09-76SR00001. 19p. NTIS, PC A02/MF A01. Order Number DE84004047.

Adjustment of the valence state of plutonium from extractable Pu(IV) to nonextractable Pu(III) in the Purex process is accomplished by addition of reductants such as Fe(II), hydroxylamine nitrate (HAN), or U(IV). To implement on-line monitoring of this reduction step for improved process control at the Savannah River Plant, a simple colorimetric method for determining excess reductant (reducing normality) was developed. The method is based on formation of a colored complex of Fe(II) with FerroZine (Hach Chemical Company). The concentration of Fe(II) is determined directly. The concentration of HAN or U(IV), in addition to Fe(II), is determined indirectly as Fe(II), produced through reduction of Fe(III). Experimental conditions for a HAN-Fe(III) reaction of known stoichiometry were established. The effect of hydrazine, which stabilizes U(IV), was also determined. Real-time measurements of color development were made that simulated on-line performance. A laboratory analytical procedure is included. 5 references, 8 figures.

5778 **(INIS-mf—8243) Radioactivity and reprocessing scrutinzed.** (Deutsche Gesellschaft fuer Wiederaufarbeitung von Kernbrennstoffen m.b.H. (DWK), Hannover (Germany, F.R.)). 1983. 51p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704620.

Reference brochure for the concepts of radioactivity, radiation, reprocessing (Purex), fuel element containments (Castor), transport containers and ultimate storage.

5779 (INIS-mf—8536, pp 18) **Three phase solvent extraction systems.** Ramirez, F. de M.; Jimenez R, M. (Instituto Nacional de Investigaciones Nucleares, Mexico City); Maddock, A.G. (Cambridge Univ. (UK). Chemical Lab.). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).

Published in summary form only.

5780 **(RHO-PB-SR—10-B-CP-Oct.83) Rockwell Hanford Operations. Chemical processing monthly report.** (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Oct 1983. Contract AC06-77RL01030. 28p. NTIS, PC A03/MF A01. Order Number DE84004567.

A letter was transmitted to the Department of Energy on October 23, 1983 requesting permission to start hot operations at the PUREX Plant. All head end systems are operationally ready to support the loading of hot fuel into dissolvers. Operations at PUREX concentrated on activities required to successfully conduct hot operations. The startup punch list of remaining items was reduced significantly. The training and certification of all operators and managers was completed in accordance with the PUREX Training Program. Startup of the solvent extraction system enhanced-readiness testing was initiated and reached steady equilibrium. Facility modifications to support the Plutonium Reclamation Facility startup were completed on schedule. This effort included installation of the 17-inch vacuum system, activation of the criticality alarm system and upgrades to the 26-inch vacuum system. Limited helicopter flight operations were initiated from leased facilities at the Richland Airport. Thirty-eight cans of plutonium metal were repackaged at the Plutonium Finishing Plant (PFP) in preparation for the first shipment of an eventual 200 kg to Los Alamos National Laboratories.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 5916

5781 **(CONF-830528—62) Legislative and Regulatory Information System: a research tool for transporting radioactive materials.** Fore, C.S.; Knox, N.P.; Fielden, J.M. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE84003289.

From 7. international symposium on packaging and transportation of radioactive materials; New Orleans, LA, USA (15 May 1983).

As part of the US Department of Energy's overall research and development program to analyze and resolve the complex problems of nuclear materials transportation, the Legislative and Regulatory Information System (LRIS) was developed at Oak Ridge National Laboratory (ORNL) as a key component of ORNL's overall Transportation Program. The information con-

tained in the LRIS has been organized into two specialized interrelated research files, the Legislative Data Base and the Operational Restrictions and Emergency Response Contacts Directory. Combined, these data bases allow interested users to quickly identify legislative restrictions as well as key state and local personnel and agencies responsible for regulating the movement of hazardous materials.

0510 Marketing And Economics

5782 **(LA-tr—83-18) Industrial integration of the fuel cycle in Argentina.** Koll, J.H.; Kittl, J.E.; Parera, C.A.; Coppa, R.C.; Aguirre, E.J. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. Translation source information not available . (CONF-770505—21-Trans.). 26p. NTIS, PC A03/MF A01. Order Number DE84000747.

From International conference on nuclear power and its fuel cycles; Salzburg, Austria (2 May 1977).

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The power-reactor construction program in Argentina for the period 1976-1985 is described on the basis of which the nuclear-fuel requirements have been determined. Activities connected with the fuel cycle commenced in 1950 in Argentina with the prospection and working of uranium deposits. On the basis of the nuclear power program described, plans have been drawn up for the establishment of the industrial plants that will be needed to ensure the domestic supply of fuel. The demand for fuel is correlated with the availability of uranium resoures and it is shown to be desirable from the technical, economic and industrial point of view to integrate the front end of the fuel cycle, keeping the irradiation aspects and the tail end at the development level. Progress made in this field and current programs covering exploration, concentrate production, nuclear purification, conversion to uranium dioxide, production of special alloys and fuel element fabrication are described.

0520 Waste Management

REFER ALSO TO CITATION(S) 5780, 5805, 5806, 5811, 5963, 6328, 6345, 6362, 6576, 6726, 6727

5783 **(BMI/ONWI—513) Salton Sea Geothermal Field, California, as a near-field natural analog of a radioactive waste repository in salt.** Elders, W.A.; Cohen, L.H. (California Univ., Riverside (USA). Inst. of Geophysics and Planetary Physics). Nov 1983. Contract AC06-76RL01830;AC02-83CH10140. 155p. NTIS, PC A08/MF A01. Order Number DE84003851.

Since high concentrations of radionuclides and high temperatures are not normally encountered in salt domes or beds, finding an exact geologic analog of expected near-field conditions in a mined nuclear waste repository in salt will be difficult. The Salton Sea Geothermal Field, however, provides an opportunity to investigate the migration and retardation of naturally occurring U, Th, Ra, Cs, Sr and other elements in hot brines which have been moving through clay-rich sedimentary rocks for up to 100,000 years. The more than thirty deep wells drilled in this field to produce steam for electrical generation penetrate sedimentary rocks containing concentrated brines where temperatures reach 365°C at only 2 km depth. The brines are primarily Na, K, Ca chlorides with up to 25% of total dissolved solids; they also contain high concentrations of metals such as Fe, Mn, Li, Zn, and Pb. This report describes the geology, geophysics and geochemistry of this system as a prelude to a study of the mobility of naturally occurring radionuclides and radionuclide analogs within it. The aim of this study is to provide data to assist in validating quantitative models of repository behavior and to use in designing and evaluating waste packages and engineered barriers. 128 references, 33 figures, 13 tables.

5784 **(BMI/ONWI—519) Response report from US Department of Energy Hearings on proposed salt site nominations.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Nov 1983. Contract AC02-83CH10140. 186p. NTIS, PC A09/MF A01. Order Number DE84003930.

As required by the Nuclear Waste Policy Act (US Congress, 1983, Pub. L. 97-425, Section 112(b) (2)), the US Department of Energy (DOE) conducted a series of nine formal public hearings during April and May 1983, in Louisiana, Mississippi, Texas, and Utah and in the state capitals of Mississippi, Texas, and Utah. The hearings were held in local communities in the vicinity of sites identified as potentially suitable for further study in the program to select a site for the nation's first repository for high-level nuclear waste. The public hearings for potential sites in salt focused on the proposed nomination of the Vacherie salt dome site in Louisiana; the Richton and Cypress Creek salt dome sites in Mississippi; the Deaf Smith County and Swisher County bedded salt sites in Texas; and the Davis and Lavender Canyon bedded salt sites in Utah. The oral and written comments made during the course of the nine formal public hearings were analyzed, paraphrased into almost 1100 comments, and grouped into 62 issues or subjects within the following nine major topical areas: National Waste Terminal Storage Program Planning Process, Consultation and Cooperation, Engineering/Repository Design, Geology, Hydrology, Transportation, Public Health and Safety, Environmental Quality, and Socioeconomics. This document provides general responses to each of the 62 major issues raised during the hearings. 137 references, 7 figures, 12 tables.

5785 **(BMI/ONWI—522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media.** Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec 1983. Contract AC06-76RL01830;AC02-83CH10140. 179p. NTIS, PC A09/MF A01. Order Number DE84004926.

Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results. Thermal expansions of salts reached 2.2 to 2.8 percent at 500°C. Associated rocks were from 0.6 to 1.6 percent. Basalts were close to 0.3 percent at 500°C. Specific heats of salts varied from 0.213 to 0.233 cal $g^{-1}C^{-1}$, and basalts averaged 0.239 cal $g^{-1}C^{-1}$. Thermal conductivities of salts at 50°C were from 0.022 to 0.046 $wcm^{-1}C^{-1}$, and at 500°C, from 0.012 to 0.027 $wcm^{-1}C^{-1}$. Basalts conductivities ranged from 0.020 to 0.022 $wcm^{-1}C^{-1}$ at 100°C and 0.016 to 0.018 at 500°C. There were no obvious conductivity trends relative to source location. Room temperature densities of salts were from 2.14 to 2.29 gcm^{-3}, and basalts, from 2.83 to 2.90 gcm^{-3}. The extreme friability of some materials made specimen fabrication difficult. 21 references, 17 figures, 28 tables.

5786 **(CONF-8311105—4) Low-level waste management program and interim waste operations technologies.** Mezga, L.J. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 8p. NTIS, PC A02/MF A01. Order Number DE84003399.

From DOE/CEA meeting on defense waste management; Knoxville, TN, USA (9 Nov 1983).

The Department of Energy currently supports an integrated technology development and transfer program aimed at ensuring that the technology necessary for the safe management and disposal of LLW by the commercial and defense sectors is available. The program focuses on five technical areas: (1) corrective measures technology, (2) improved shallow land burial technology, (3) greater confinement disposal technology, (4) model development and validation, and (5) treatment methods for problem wastes. The results of activities in these areas are reported in the open literature and the Proceedings of the LLWMP Annual Participants Information Meeting.

5787 **(DOE/SR-WM—84-1-Rev.1) Savannah River interim waste management program plan: FY 1984. Revision 1.** (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). Oct 1983. Contract AC09-76SR00001. 79p. NTIS, PC A02/MF A01. Order Number DE84004646.

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This document provides the program plan as requested by the Savannah River Operations Office of the Department of Energy. The plan was developed to provide a working knowledge of the nature and extent of the interim waste management programs being undertaken by Savannah River (SR) contractors for the Fiscal Year 1984. In addition, the document projects activities for several years beyond 1984 to adequately plan for safe handling and storage of radioactive wastes generated at Savannah River and for developing technology for improved management of low-level solid wastes. A revised plan will be issued prior to the beginning of the first quarter of each fiscal year. In this document, work descriptions and milestone schedules are current as of the date of publication. Budgets are based on available information as of June 1983.

5788 **(DOE/WM/46642—1) Vermont's involvement with the DOE's National Waste Terminal Storage program. Progress report, February 2, 1982-October 31, 1983.** Fischer, R.M. (Vermont Agency of Environmental Conservation, Montpelier (USA)). 1983. Contract FG02-81WM46642. 18p. NTIS, PC A02/MF A01. Order Number DE84004557.

The status of the regional characterization work being done in Vermont for the National Waste Terminal Storage program is given.

5789 **(DPSPU—61-11-16) Contamination and attempted decontamination of the hot gang valve corridor and first-level clean facilities of Building 221-F, September 13-December 31, 1960.** Nichols, D.C. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). Jul 1961. Contract AC09-76SR00001. 10p. NTIS, PC A02. Order Number DE84001535.

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On September 13, 1960, failure of the Building 221-F high activity waste evaporator reboiler (tube bundle 9.3), followed by both communications and valving errors, resulted in the release of approximately 600 gallons of cooling water onto the hot gang valve corridor (HGVC) floor. This water, containing 5000 to 10,000 curies of fission products from the Purex process, flowed down a connecting stairwell through an airlock into the First Level clean corridor, the Health Physics office, and into a portion of the locker room facilities. Initial attempts to decontaminate Sections 14 through 18 of the HGVC were unsuccessful and attention was then given to cleaning the contaminated First Level facilities. Mop heads, absorbent pads, and clothing used to contain the contaminated water were transferred to steel waste drums. The First Level corridor was then mopped with a detergent solution. Since no appreciable radiation reduction was realized and since these facilities were not essential to building operation, temporary measures were employed to contain the contamination. Attention was again focused on the HGVC and extensive shielding was placed over the highly contaminated areas in order that productive use of Building 221-F might be resumed. Decontamination was resumed and volunteer personnel were authorized to receive one roentgen of gamma radiation in a single dose.

5790 **(DPST—80-110-4) TNX continuous melter startup.** Willis, T.A. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 16 May 1980. Contract AC09-76SR00001. 10p. NTIS, PC A02/MF A01. Order Number DE84003481.

The full-scale TNX cylindrical melter will be startd up and subsequently operated with calcine feed. The startup method selected is by heatup of the melter to operating temperature with propane burners. Discussions, a visit and correspondence with the representative of Hotwork, Inc. of Lexington, Kentucky, explored the techniques of a propane burner startup. Also discussed with the vendor was potential repair work on the melter. We are planning for these potential repair jobs to that if they must be performed they can be done safely and with minimum equipment downtime.

5791 **(EGG-M—20283) Licensing retrofit incinerators at commercial nuclear power plants.** Dodge, R.L.; Edwards, C.W.; Wilson, B. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 7p. (CONF-831047—101). NTIS, PC A02/MF A01. Order Number DE84002224.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

In order to determine whether or not a backfit incinerator could be licensed under the provisions of 10 CFR Part 50.59, Gilbert Associates, Inc., with support from the Department of Energy, prepared, on a generic basis, typical engineering design information, accident analysis data and other documentation necessary to apply to the Nuclear Regulatory Commission for a license to backfit a low-level radioactive waste incinerator in an operating nuclear power plant. The Department of Energy, serving in the role of a typical utility organization, submitted this generic report to the Nuclear Regulatory Commission for review and comment in a mock demonstration of the licensing process. The ultimate goal of this effort is to identify and resolve any safety issues associated with backfit incinerators so that a sufficient level of confidence in the licensability of backfit incinerators can be installed in nuclear utility management, and to encourage the industry to actually proceed with plans to install incinerators on a retrofit basis.

5792 **(ENICO—1116-Suppl.1(10-83)) ICPP 2nd quarter 1983 effluent monitoring report. Supplement 1.** (Exxon Nuclear Idaho Co., Inc., Idaho Falls (USA)). Oct 1983. Contract AC07-79ID01675. 57p. NTIS, PC A04/MF A01. Order Number DE84003515.

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This report summarizes the data collected for effluent and environmental monitoring programs conducted at ICPP by the Effluent Monitoring and Environmental Sciences Subsection. The period covered by this report is from March 20, 1983 through June 19, 1983. During the 2nd quarter of 1983, 3415 curies of radioactive material were disposed of from ICPP operations. Airborne effluent releases to the atmosphere contributed 3011 curies; liquid effluent releases through the disposal well contributed 342.5 curies; and solid waste shipped to the Radioactive Waste Management Complex (RWMC) contained 62 curies.

5793 **(LA-UR—83-3341) Numerical simulation of flow and transport in partially saturated, fractured tuff.** Travis, B.J.; Hodson, S.W.; Cook, T.L.; Nuttall, H.E.; Rundberg, R. (Los Alamos National Lab., NM (USA); Nuttall and Associates, Inc., Albuquerque, NM (USA)). 1983. Contract W-7405-ENG-36. 17p. (CONF-831174—27). NTIS, PC A02/MF A01. Order Number DE84003795.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

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The unsaturated, fractured tuff of Yucca Mountain in the Nevada Test Site is one of the target sites for geologic storage of high-level radioactive waste. A modeling study of flow and transport in this geologically complex site is presented. Numerical models of mass and heat flow in conjunction with analytical solutions are being used for sensitivity and pathway analysis studies and to aid in design and interpretation of laboratory and field flow and transport tests in tuff. 11 references, 9 figures, 1 table.

5794 **(NUREG/CR—2870) Characterization of the radioactive large quantity waste package of the Union Carbide Corporation.** Gause, E.P.; Stang, L.G.; Dougherty, D.R.; Veakis, E.; Smalley, J. (Brookhaven National Lab., Upton, NY (USA)). Nov 1983. Contract AC02-76CH00016. 99p. (BNL-NUREG—51576). NTIS, PC A05/MF A01 - GPO $4.75. Order Number DE84004565.

An evaluation of a specific low-level waste disposal package was made on the basis of proposed 10 CFR Part 61 criteria (dated June 29, 1981). This evaluation was the result of a study initiated by the U.S. Nuclear Regulatory Commission (NRC), in which the Union Carbide Corporation (UCC) participated. UCC produces ^{90}Mo by the fissioning of ^{235}U. The other fission products constitute a type of low-level radioactive waste which is packaged for disposal by commercial shallow land burial. The evaluation of this

package showed that: (1) it is within proposed 10 CFR Part 61 Class B limits; and (2) it meets the proposed 10 CFR Part 61 criteria with the exception of the long-term stability criteria. Possible alternatives for complying with the long-term stability criteria are identified. 70 references, 4 figures, 14 tables.

5795 **(NUREG/CR—2977) Tests of absorbents and solidification techniques for oil wastes.** Lin, M.; MacKenzie, D.R. (Brookhaven National Lab., Upton, NY (USA)). Nov 1983. Contract AC02-76CH00016. 66p. (BNL-NUREG—51589). NTIS, PC A04/MF A01 - GPO $4.50. Order Number DE84004733.

A representative of each of six classes of commonly used adsorbents was chosen for a series of tests. After reviewing ASTM and other related standard tests, uncomplicated procedures were developed for carrying out specific tests to determine absorbency for simulated oil waste and for water, under static and simulated transportation (repetitive shock) conditions. The tests were then applied to the six representative absorbents. Solidification tests were performed using these absorbents saturated with oil and loaded to 50% of saturation. The binders used were Portland I cement and Delaware Custom Material (DCM) cement shale silicate. Samples were checked for proper set, and the amounts of free liquid were measured. Another series of tests was performed on samples of simulated oil waste without absorbent, using Portland cement and DCM cement shale silicate. Samples were checked for proper set, free liquid was measured, and compressive strengths were determined. The state-of-the-art parameters were identified which satisfy NRC disposal criteria for solidified radioactive waste. The literature was reviewed for alternative methods of managing oil wastes. Conclusions are drawn on the relative utility of the various methods. 17 references, 3 tables.

5796 **(PNL-SA—11218) Radiation effects on nuclear waste storage materials.** Weber, W.J.; Pederson, L.R.; Gray, W.J.; McVay, G.L. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1983. Contract AC06-76RL01830. 25p. (CONF-830573—9). NTIS, PC A02/MF A01. Order Number DE84003206.

From 2. international conference on radiation effects in insulators; Albuquerque, NM, USA (30 May 1983).

Three aspects of radiation effects regarding the repository storage of nuclear waste materials are discussed. The effects of self-radiation damage result in swelling and enhanced leaching of the host material for the radioactive wastes. The effects are minimal in glasses but more pronounced in crystalline waste forms. Groundwaters exposed to radiation will, as a result of radiolysis, for free radicals and molecular species that can alter the repository environment and, under certain conditions, may enhance the release of radionuclides from the repository. In a salt repository, gamma radiation can lead to the formation of colloidal sodium metal and free chlorine in the crystalline salt, which may also alter the repository environment upon dissolution.

5797 **(PNL-SA—11456) Behavior of ^{99}Tc in doped-glass/basalt hydrothermal interaction tests.** Coles, D.B.; Apted, M.J. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1983. Contract AC06-76RL01830. 9p. (CONF-831174—34). NTIS, PC A02/MF A01. Order Number DE84003207.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

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The release of polyvalent radionuclides from a nuclear waste repository located in basalt may be sensitively related to the redox potential (Eh) imposed by the basalt. A series of tests are reported here, evaluating the effect of basalt on the concentrations of ^{99}Tc released into solution from a borosilicate glass waste form. Crushed PNL 76 to 68 glass, doped with 0.7 mg ^{99}Tc/g glass, was reacted with reference basalt groundwater under oxic hydrothermal conditions in a sampling autoclave, both alone and in the presence of crushed basalt. The steady-state fluid concentrations of ^{99}Tc and various stable species were determined from samples obtained at the test conditions of 200°C, 30 MPa, and an initial solution-to-solid mass ratio of 10 for both tests. In the glass + groundwater test, the ^{99}Tc concentration rose rapidly to about 50 mg/L after only 200 hr of run time and remained at a value between 50 and 60 mg/L throughout the duration of the test. For the basalt + glass + groundwater test, the ^{99}Tc concentration rose to an initial value of about 2.5 mg/L. At about 700 hr, the ^{99}Tc concentration began to drop rapidly until a value near the analytical detection limit (approximately 0.01 mg/L) was reached after a test duration of 1400 hr. It is concluded that the presence of basalt in these hydrothermal experiments reduces the concentration of ^{99}Tc in solution by nearly four orders of magnitude, probably by control of solution Eh and subsequent precipitation of a solid containing a reduced form of technetium. Reaction mechanisms are discussed that can account for these observations. 17 references, 1 figure.

5798 **(RFP—3542) Alternatives for reducing transuranic waste generation.** Jensen, R.T. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 24 Oct 1983. Contract AC04-76DP03533. 16p. NTIS, PC A02/MF A01. Order Number DE84003458.

Eight proposals were carefully analyzed for cost and potential waste reduction. Out of these eight projects, it is recommended that the TRU Waste Systems Office fund three of them. The first is the Ferrite Waste Treatment Process. Initial research has been completed on this project. This method would replace alkaline, agglomeration-precipitation methods for purifying liquid waste. Second, it is recommended that an engineering study of materials and glove box techniques be done. The objective would be to find materials that can be reused, that resist corrosion, or that have increased lifetimes. (Better pumps, labware, tools, sponges.) In addition, methods for cleaning and maintaining the glove boxes could be studied. Finally, it is recommended that a waste billing system be used with contractors who ship waste to Idaho Falls. This recommendation is made with some reservation. There are many who believe that such a system is not workable. Opinions seem to be split among engineers at sites that currently use this method. It appears that when the generator is made to really feel the additional costs of disposal, waste reduction efforts do increase. If it is possible to beat the system however, such a method will only result in more paperwork and expense. Each method was appraised in a series of evaluation steps. Some of these steps were designed to narrow the scope of this report. For this reason, some ideas were not considered but could, in fact, be very effective in reducing waste. Included among them were post-generation techniques such as incineration and compaction. In addition, there was a definite need for education and training about waste management. 11 references, 6 tables.

5799 **(RHO-PB-SR—10-B-WM-Oct.83) Defense waste and byproducts management. Monthly report, October 1983.** (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Oct 1983. Contract AC06-77RL01030. 74p. NTIS, PC A04/MF A01. Order Number DE84004611.

The draft of the revised Hanford Waste Management Plan (HWMP) has been completed and is currently in review. Extensively rewritten, the draft document covers all aspects of waste management with emphasis on the final deposition of the waste materials. Key to the plan is the division of wastes and retrievably-stored wastes. Approximately 116,000 gallons were jet pumped from BY Tank Farm saltwells in the month of October. Five jet pumps are currently operational in BY Tank Farm: Tanks 101-BY, 104-BY, 110-BY, 111-BY and 112-BY. Ten strontium capsules were produced in October. All cesium recycle material was purified and transferred to WESF for encapsulation. This completes a major Waste Management processing campaign initiated 16 years ago when cesium was first recovered from waste in B Plant. The review of tank farm facilities for PUREX Startup was completed by the PUREX Readiness Review Board; The Board submitted a letter to the Rockwell Director of Plant Operations certifying the Tank Farms were ready to receive PUREX waste. This action formalized Waste Management readiness to receive PUREX waste. Nineteen cesium capsules were produced in October. This completes the encapsulation of cesium initiated in 1974. Phase V decontamination and decommissioning of the 204-S Waste Unloading Facility was initiated. During October, the 204-S pumphouse was decontaminated and decommissioned and construction of the roadway to transport the 204-S tanks to the burial ground was completed. Decontamination and decommissioning of 204-S is now projected to be complete by mid-January 1984, over two months ahead of

schedule. Two shipments of transuranic (TRU) waste were received from Kerr-McGee.

5800 **(SAND—81-0912) In-Situ Tuff Water Migration/ Heater Experiment: posttest thermal analysis.** Eaton, R.R.; Johnstone, J.K.; Nunziato, J.W.; Korbin, C.M. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1983. Contract AC04-76DP00789. 71p. NTIS, PC A04/MF A01. Order Number DE84003366.

This report describes posttest laboratory experiments and thermal computations for the In-Situ Tuff Water Migration/Heater Experiment that was conducted in Grouse Canyon Welded Tuff in G-Tunnel, Nevada Test Site. Posttest laboratory experiments were designed to determine the accuracy of the temperatures measured by the rockwall thermocouples during the in-situ test. The posttest laboratory experiments showed that the measured in-situ rockwall temperatures were 10 to 20°C higher than the true rockwall temperatures. The posttest computational results, obtained with the thermal conduction code COYOTE, were compared with the experimentally obtained data and with calculated pretest results. Daily heater output power fluctuations (+-4%) caused by input power line variations and the sensitivity of temperature to heater output power required care in selecting the average heater output power values used in the code. The posttest calculated results compare reasonably well with the experimental data. 10 references, 14 figures, 5 tables.

5801 **(UCRL—90044) Waste package for a repository located in tuff.** Ballou, L.B. (Lawrence Livermore National Lab., CA (USA)). Nov 1983. Contract W-7405-ENG-48. 13p. (CONF-831217—1). NTIS, PC A02/MF A01. Order Number DE84003894.

From 5. civilian radioactive waste management information meeting; Washington, DC, USA (12 Dec 1983).

The development of waste packages for emplacement in a tuff repository has been proceeding during the past year on a broad front. Experimental work has been focused on determination of important package environment parameters and testing the response of waste forms and package materials to the anticipated environment. Conceptual designs have been selected with alternatives to accommodate present uncertainties in the environment and material performance. Computational capabilities are being adapted to provide analyses of anticipated package performance, and plans are being developed for in-situ testing. The waste package activities have been integrated into the overall NNWSI project to assure timely completion consistent with the statutory and regulatory requirements leading to repository site selection around the end of the decade. 7 references.

5802 **(USGS-OFR—83-732) Stratigraphy, structure, and some petrographic features of Tertiary volcanic rocks at the USW G-2 drill hole, Yucca Mountain, Nye County, Nevada.** Maldonado, F.; Koether, S.L. (Geological Survey, Denver, CO (USA); Fenix and Scisson, Inc., Tulsa, OK (USA)). 1983. Contract AI08-78ET44802. 93p. NTIS, PC A05/MF A01. Order Number DE84003918.

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A continuously cored drill hole penetrated 1830.6 m of Tertiary volcanic strata comprised of the following in descending order: Paintbrush Tuff, tuffaceous beds of Calico Hills, Crater Flat Tuff, lava and flow breccia (rhyodacitic), tuff of Lithic Ridge, bedded and ash-flow tuff, lava and flow breccia bedded tuff, conglomerate and ash-flow tuff, and older tuffs of USW G-2. Comparison of unit thicknesses at USW G-2 to unit thicknesses at previously drilled holes at Yucca Mountain indicate: (1) thickening of the Paintbrush Tuff members and tuffaceous beds of Calico Hills toward the northern part of Yucca Mountain; (2) thickening of the Prow Pass Member but thinning of the Bullfrog Member and Tram unit; (3) thinning of the tuff of Lithic Ridge; (4) presence of about 280 m of lava and flow breccia not previously penetrated by any drill hole; and (5) presence of an ash-flow tuff unit at the bottom of the drill hole not previously intersected, apparently the oldest unit penetrated at Yucca Mountain to date. Petrographic features of some of the units include: (1) decrease in quartz and K-feldspar and increases in biotite and plagioclase with depth in the tuffaceous beds of Calico Hills; (2) an increase in quartz phenocrysts from the top to the bottom members of the Crater Flat Tuff; (3) a low quartz content in the tuff of Lithic Ridge, suggesting tapping of the magma chamber at quartz-poor levels; (4) a change in zeolitic alteration from heulandite to clinoptilolite to mordenite with increasing depth; (5) lavas characterized by a rhyolitic top and dacitic base, suggesting reverse compositional zoning; and (6) presence of hydrothermal mineralization in the lavas that could be related to an itrusive under Yucca Mountain or to volcanism associated with the Timber Mountain-Claim Canyon caldera complex. A fracture analysis of the core resulted in tabulation of 7848 fractures, predominately open and high angle.

5803 **(PNL-tr—437) Studies of the setting behavior of cement suspensions.** Rudolph, G.; Luo, S.; Vejmelka, P.; Koester, R. (Pacific Northwest Lab., Richland, WA (USA); Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). Oct 1983. Contract AC06-76RL01830. Translation of KFK--3401, September 1982. 45p. NTIS, PC A03/MF A01. Order Number DE84002815.

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The design of process for cementation of radioactive waste solutions is determined not only by the quality of the final product but also by the behavior of the cement grout before and during setting. For these reasons quantitative investigations were performed on the characteristics of the cement suspensions considered for solidification of intermediate-level liquid wastes which are composed mainly of cement, bentonite, simulated waste solution, and water. Particular interest was given to the differences in behavior of the various types of cement. The parameters investigated include viscosity, bleeding, volume change during setting, influence of compacting by vibration, time of setting, heat of hydration. At the end of the report the merits and drawbacks of the different cements are tabulated. These data may serve as a decision aid in selecting an appropriate type of cement.

5804 **dpa Hintergrund. (Dpa documentation on pollution control: Problem and topological task. Disposal of waste from nuclear power plants in the FRG. Pt. 1-3).** Olthof, G. Hamburg, Germany, F.R.; Deutsche Presse-Agentur G.m.b.H. (1982). vp. (In German). Available from Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe (Germany, F.R.).

Comprehensive documentation in three parts stating the problems and tasks to be tackled with regard to the management of waste from nuclear power plants in the FRG. The material and information presented in this review is discussed under the following three main headings: 1. Figures and facts of nuclear waste management, a problem still unresolved; 2. Waste management concepts and strategies and related methods; 3. History of nuclear waste management.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 5783, 5793, 5797

5805 **(CONF-8308126—4) Effect of aged waste package and basalt on radioelement release.** Seitz, M.G.; Vandegrift, G.F.; Bowers, D.L.; Gerding, T.J. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 18p. NTIS, PC A02/MF A01. Order Number DE84003457.

From NRC research annual review meeting of nuclear waste management research on geochemistry of HLW disposal; Reston, VA, USA (30 Aug 1983).

Results of experiments are described that combine backfill, radioactive waste, and repository host rock in a single flowing groundwater stream in a manner analogous to a hydraulic breach of a waste repository. The experimental design is used to identify the chemical interactions that would occur if repository components were breached by flowing water. The results indicate that of three parameters studied, the alteration of the repository components as might occur upon aging had the most substantial influence on the migration of radioactive elements dissolved from the solid radioactive waste. The other two parameters, the metal alloy used in the apparatus and an ionizing radiation field imposed on the experimental apparatus, had little or no measurable effect on radioactive ele-

ment transport by flowing water. Inasmuch as the alteration of the repository materials represent aging in an actual repository, it is concluded that changes with age may detrimentally affect the ability of a repository to isolate plutonium and neptunium, and possibly other radioactive elements in nuclear waste. 37 references, 2 figures, 2 tables.

5806 **(PNL—4608-4) Uranium recovery research sponsored by the Nuclear Regulatory Commission at Pacific Northwest Laboratory. Quarterly progress report, June-September 1983.** Foley, M.G.; Deutsch, W.J.; Gee, G.W.; Hartley, J.N.; Kalkwarf, D.R.; Mayer, D.W.; Nelson, R.W.; Opitz, B.E.; Peterson, S.R.; Serne, R.J. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1983. Contract AC06-76RL01830. 49p. NTIS, PC A03/MF A01. Order Number DE84003755.

This report documents progress for the following major research projects: stabilization, engineering, and monitoring alternatives assessment for improving regulation of uranium recovery operations and waste management; attenuation of radon emission from uranium tailings; assessment of leachate movement from uranium mill tailings; and methods of minimizing ground-water contaminants from in-situ leach uranium mining.

0540 Health And Safety

5807 **(CONF-830609—62) Survey of shielding data and methods for fuel reprocessing applications.** Ingersoll, D.T. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE84003195.

From ANS annual meeting; Detroit, MI, USA (12 Jun 1983).

A survey was conducted to determine the present status of nuclear data, computational methods, and integral data applicable to shielding design for fuel reprocessing plants. It was concluded that the general status of the data and methods is good, and that many of the improvements which have resulted from reactor programs serve equally well for reprocessing applications. However, a few additional areas of concern were identified which are generic to reprocessing applications and some of which are specific to particular design concepts.

5808 (INIS-mf—8536, pp 75) **Environmental radiocontamination: Po^{210} traces in air and water from uranium mines.** Mansur N, E.; De Andrade, S.A.; Mansur, H.N.S.; Copray, W.J.A. (Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Quimica). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).

Published in summary form only.

5809 (INIS-mf—8536, pp 76) **Environmental radiocontamination: Ra^{226} traces in air and water from uranium mines.** Mansur N, E.; De Andrade, S.A.; Mansur, H.N.S.; Copray, W.J.A. (Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Quimica). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).

Published in summary form only.

5810 **(K/P—6770) Criticality emergency preparedness at the Oak Ridge Gaseous Diffusion Plant.** Peterson, C.H. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 1983. Contract W-7405-ENG-26. 6p. (CONF-831047—97). NTIS, PC A02/MF A01. Order Number DE84002449.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

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The principle of gaseous diffusion as a method of uranium (^{235}U) enrichment is briefly summarized. This process has a potential for a criticality, although in the 40 years of operation at ORGDP, none has occurred. Prevention planning for criticality is described. The work of the Criticality Safety Group is explained and the emergency plan is outlined. (DMC)

5811 **(NUREG/CR—2808) GWMBNL1: a computer model for groundwater transport of radioactive isotopes and dose rate calculation.** Sastre, C.; Hsu, C.; Colman, J. (Brookhaven National Lab., Upton, NY (USA)). Nov 1983. Contract AC02-76CH00016. 83p. (BNL-NUREG—51553). NTIS, PC A05/MF A01- GPO $4.50. Order Number DE84004561.

The computer code GWMBNL1 computes the dose rate to a member of the public using the water from a well or a river located in the proximity of a hypothetical low-level waste disposal site. The code is an implementation of the Atomic Industrial Forum methodology and is based on TVAG6 and TECGWM from Technology for Energy Corporation.

0550 Regulations

REFER ALSO TO CITATION(S) 5775, 5780, 6005, 6290

5812 **(CONF-831106—1) Isotope correlations for safeguards and accountability of LWR fuel cycles.** Persiani, P.J.; Kalimullah; Bucher, R.G.; Pond, R.B. (Argonne National Lab., IL (USA)). May 1983. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01. Order Number DE83015675.

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

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The two questions that must be addressed in a fuel reprocessing plant to close the material balance in a fuel cycle between fabrication plant and reprocessing plant are: (a) what is the nuclear material content in the dissolver tank? and (b) what should be the nuclear material content in the dissolver tank? An isotope correlation technique was used to address these questions and programmed on a computer for implementation and assessment.

5813 **(LA—9935-MS) Improved attribute sampling plans for materials accounting.** Goldman, A.S. (Los Alamos National Lab., NM (USA)). Nov 1983. Contract W-7405-ENG-36. 17p. NTIS, PC A02/MF A01. Order Number DE84003970.

The Safeguards Systems Group at the Los Alamos National Laboratory has been requested to study attribute sampling plans requiring minimal sample sizes for the purpose of reducing personnel time and radiation exposure in item inventories of nuclear materials. Results indicate that double sampling plans can generally reduce the work effort by at least 30% compared with the single sampling plans currently used at the Los Alamos plutonium facility. Such innovations should be applicable to any DOE facility engaged in processing nuclear materials, particularly in low-turnover storage areas. Future work includes the study of multiple sampling plans as a possible procedure for further reduction of sample sizes.

5814 **(LA-UR—83-3199) End-crop box counter.** Sprinkle, J.K. Jr. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 8p. (CONF-831106—11). NTIS, PC A02/MF A01. Order Number DE84003772.

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

A nondestructive assay instrument that measures large quantities of low-enriched uranium metal is described. The assay is based on the spontaneous totals neutron signal.

5815 **(LA-UR—83-3252) Measurement control program for NDA instruments.** Hsue, S.T.; Marks, T. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 5p. (CONF-831106—18). NTIS, PC A02/MF A01. Order Number DE84003801.

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

Measurement control checks for nondestructive assay instruments have been a constant and continuing concern at Los Alamos National Laboratory. This paper summarizes the evolution of the measurement control checks in the various high-resolution gamma

systems we have developed. In-plant experiences with these systems and checks will be discussed. Based on these experiences, a set of measurement control checks is recommended for high-resolution gamma-ray systems.

5816 **(LA-UR—83-3265) Are 0.1%-accurate gamma-ray assays possible for ^{235}U solutions.** Parker, J.L. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 14p. (CONF-831106—10). NTIS, PC A02/MF A01. Order Number DE84003802.

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

The factors influencing the accuracy of passive gamma-ray assay of uniform, homogeneous solution samples have been studied in some detail, particularly for the assay of ^{235}U in uranium solutions. Factors considered are the overall long-term electronic stability, the information losses caused by the rate-related electronic processes of pulse pileup and dead-time, and the self-attenuation of gamma rays within the samples. Both experimental and computational studies indicate that gamma-ray assay procedures for solution samples of moderate size (from ~ 10 to perhaps a few hundred milliliters) are now capable of accuracies approaching 0.1% in many practical cases.

5817 **(LA-UR—83-3266) Direct fissile assay of highly enriched UF_6 using random self-interrogation and neutron coincidence response.** Stewart, J.E.; Menlove, H.O. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 20p. (CONF-831106—12). NTIS, PC A02/MF A01. Order Number DE84003780.

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

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A new nondestructive method for direct assay of ^{235}U mass contained in Model 5A uranium hexafluoride (UF_6) product storage cylinders has been successfully tested in the laboratory and under field conditions. The technique employs passive neutron self-interrogation and uses the ratio of coincidences-to-totals counts as a measure of bulk fissile mass. The accuracy of the method is 6.8% (1 σ) based on field measurements of 44 Model 5A cylinders, 11 of which were either only partially filled or contained reactor return material. The cylinders contained UF_6 with enrichments from 5.96% to 97.6%. Count times were 3 to 6 min depending on ^{235}U mass. Samples ranged from below 1 kg to over 16 kg of ^{235}U. Because the method relies primarily on fast neutron self-interrogation, complete sampling of the UF_6 takes place. This feature alleviates inhomogeneity problems and offers increased assurance of the presence of stated amounts of bulk fissile material as compared with current verification methods.

5818 **(LA-UR—83-3298) Development of an enrichment monitor for the Portsmouth GCEP.** Strittmatter, R.B.; Stovall, L.A.; Sprinkle, J.K. Jr. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 6p. (CONF-831106—14). NTIS, PC A02/MF A01. Order Number DE84003788.

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

We have developed a gas-phase UF_6 enrichment monitor for use by the International Atomic Energy Agency at the Portsmouth Gas Centrifuge Enrichment Plant. The enrichment monitoring system provides a method for effective nuclear materials accountability verification while reducing the effort for both the facility operator and the inspector. The experience with an inplant prototype monitor, the facility and operational constraints, and the constraints related to international safeguards inspection are described in terms of the impact on the monitor design.

5819 **(LA-UR—83-3299) Comparison of predicted and measured pulsed-column profiles and inventories.** Ostenak, C.A.; Cermak, A.F. (Los Alamos National Lab., NM (USA); Allied-General Nuclear Services, Barnwell, SC (USA)). 1983. Contract W-7405-ENG-36. 13p. (CONF-831106—15). NTIS, PC A02/MF A01. Order Number DE84003789.

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

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Nuclear materials accounting and process control in fuels reprocessing plants can be improved by near-real-time estimation of the in-process inventory in solvent-extraction contactors. Experimental studies were conducted on pilot- and plant-scale pulsed columns by Allied-General Nuclear Service (AGNS), and the extensive uranium concentration-profile and inventory data were analyzed by Los Alamos and AGNS to develop and evaluate different predictive inventory techniques. Preliminary comparisons of predicted and measured pulsed-column profiles and inventories show promise for using these predictive techniques to improve nuclear materials accounting and process control in fuels reprocessing plants.

5820 **(LA-UR—83-3320) Operation of automated NDA instruments for in-line HEU accounting at Y-12.** Russo, P.A.; Strittmatter, R.B.; Sandford, E.L.; Jeter, I.W.; McCullough, E.; Bowers, G.L. (Los Alamos National Lab., NM (USA); Oak Ridge Y-12 Plant, TN (USA)). 1983. Contract W-7405-ENG-36. 30p. (CONF-831106—16). NTIS, PC A03/MF A01. Order Number DE84003793.

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

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Two automated nondestructive assay instruments developed at Los Alamos in support of nuclear materials accounting needs are currently operating in-line at the Y-12 Plant for recovery of highly enriched uranium. One instrument provides the HEU inventory in the secondary solvent extraction system, and the other monitors HEU concentration in the secondary intermediate evaporator. Both instruments were installed in December 1982. Operational evaluation of these instruments has been a joint effort of Y-12 and Los Alamos. This has included comparison of the solvent extraction system inventories with direct measurement performed on the dumped solution components of the solvent extraction system, as well as comparisons of concentration assay results with the external assays of samples withdrawn from the process. The function, design, and preliminary results of the operational evaluation are reported.

5821 **(LA-UR—83-3325) Process: (international) safeguards interface at the Portsmouth GCEP from the safeguards technology developer's viewpoint.** Tape, J.W.; Strittmatter, R.B.; Baker, A.L. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 6p. (CONF-831106—17). NTIS, PC A02/MF A01. Order Number DE84003792.

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

The design of a major portion of a safeguards system for possible use by IAEA at the Portsmouth Gas Centrifuge Enrichment Plant is described from the viewpoint of the safeguards technology developer. The process-safeguards interface is reviewed, including safeguards, process, and operational constraints on the safeguards system. The conflicting requirements of the IAEA and the plant operator are minimized through the use of advanced technology that allows safeguards data to be acquired, analyzed, and reported in an automated, unattended mode. The proposed safeguards system will reduce the impact of the inspections on both the operator and the IAEA.

5822 **(LA-UR—83-3344) Modeling and simulation for process and safeguards system design.** Gutmacher, R.G.; Kern, E.A.; Duncan, D.R.; Benecke, M.W. (Los Alamos National Lab., NM (USA); Westinghouse Hanford Co., Richland, WA (USA)). 1983. Contract W-7405-ENG-36. 8p. (CONF-831106—13). NTIS, PC A02/MF A01. Order Number DE84003845.

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

A computer modeling and simulation approach that meets the needs of both the process and safeguards system designers is described. The results have been useful to Westinghouse Hanford Company process designers in optimizing the process scenario and operating scheme of the Secure Automated Fabrication line. The combined process/measurements model will serve as the basis for design of the safeguards system. Integration of the process design and the safeguards system design should result in a smoothly operating process that is easier to safeguard.

5823 **(LA-UR—83-3382) Fast facility spent-fuel and waste assay instrument.** Eccleston, G.W.; Johnson, S.S.; Menlove, H.O.; Van Lyssel, T.; Black, D.; Carlson, B.; Decker, L.; Echo, M.W. (Los Alamos National Lab., NM (USA); Exxon Nuclear Idaho Co., Inc., Idaho Falls (USA)). 1983. Contract W-7405-ENG-36. 16p. (CONF-831106—8). NTIS, PC A02/MF A01. Order Number DE84003839.

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

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A delayed-neutron assay instrument was installed in the Fluorinel Dissolution and Fuel Storage Facility at Idaho National Engineering Laboratory. The dual-assay instrument is designed to measure both spent fuel and waste solids that are produced from fuel processing. A set of waste standards, fabricated by Los Alamos using uranium supplied by Exxon Nuclear Idaho Company, was used to calibrate the small-sample assay region of the instrument. Performance testing was completed before installation of the instrument to determine the effects of uranium enrichment, hydrogenous materials, and neutron poisons on assays. The unit was designed to measure high-enriched uranium samples in the presence of large neutron backgrounds. Measurements indicate that the system can assay low-enriched uranium samples with moderate backgrounds if calibrated with proper standards.

5824 **(LA-UR—83-3383) Materials loss-detection sensitivities using process-grade measurements at AGNS BNFP.** Dayem, H.A.; Hakkila, E.A.; Baker, A.L.; Cobb, D.D. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 7p. (CONF-831106—7). NTIS, PC A02/MF A01. Order Number DE84003843.

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

Process quality measurement data from cold runs at AGNS BNFP are used to demonstrate near-real-time accounting by closing hourly materials balances and to evaluate contractor inventory estimation techniques. Loss-detection sensitivities for 1 day of between 4 and 18 kg uranium, at 50% detection probability and 2.5% false-alarm probability, are calculated for selected accounting areas. Pulsed-column inventory estimators are used to calculate an inventory that is generally within 10% of column dump measurements. Loss-detection sensitivity could be improved by incorporating on-line waste stream measurements, improving laboratory measurements for process streams, and refining the pulsed-column inventory estimates.

5825 **(LA-UR—83-3403) Materials control and accounting (MC and A): the evolutionary pressures.** Shipley, J.P. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 5p. (CONF-831106—9). NTIS, PC A02/MF A01. Order Number DE84003848.

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

Nuclear materials control and accounting systems are subject to pressures of both regulatory and institutional natures. This fact, coupled with the emergence of new technology, is causing evolutionary changes in materials control and accounting systems. These changes are the subject of this paper.

5826 **(NUREG/CR—3522-Vol.1) Reference materials for nondestructive assay of special nuclear material. Volume 1. Uranium oxide plus graphite powder.** Sprinkle, J.K.; Likes, R.N.; Parker, J.L.; Smith, H.A. (Los Alamos National Lab., NM (USA)). Oct 1983. Contract W-7405-ENG-36. 35p. (LA—9910-MS-Vol.1). NTIS, PC A03/MF A01 - GPO. Order Number DE84003979.

This manual describes the fabrication of reference materials for use in gamma-ray-based nondestructive assay of low-density uranium-bearing samples. The sample containers are 2-l bottles. The reference materials consist of small amounts of UO_2 spread throughout a graphite matrix. The ^{235}U content ranges from 0 to 100 g. The manual also describes the far-field assay procedure used with low-resolution detectors.

5827 **(SAND—83-0958C) Application of integer programming to the deployment of security officers within a generic nuclear power plant.** Rountree, S.L.K. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 10p. (CONF-831189—1). NTIS, PC A02/MF A01. Order Number DE84002535.

From ORSA/TIMS joint national meeting; Orlando, FL, USA (7 Nov 1983).

The SECURity Officer Response Strategies (SECURORS) approach provides a method for determining security force deployment locations within a nuclear power plant to interrupt sequences of adversary actions which could lead to a radioactive release. The technique is applied to a nine-level generic nuclear power plant to determine locations for deployment subsequent to detection of an adversary intrusion. The security officers are deployed to intercept the adversaries at points along the adversary intrusion paths, since the security force generally is not large enough to deploy one security officer to each vital area (sabotage target). This general deployment approach is in contrast to a response to the specific area(s) where the alarm or intrusion occurred. Extensive use has been made of the facility layout drawings, the facility region information, and the pathfinder critical path results - available from the Safeguards Automated Facility Evaluation (SAFE) analysis of the nine-level facility - in order to focus on the problem of security officer deployment and to relate the SECURORS method to a currently available facility analysis methodology.

07 Radiation Sources

REFER ALSO TO CITATION(S) 6465, 6466, 6468, 6471, 6480, 6481

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 6131

5828 **(DOE/ID/12221—T1) Alternative fuels feasibility study K-FUEL. Final report.** (Kearney (A.T.), Inc., Alexandria, VA (USA)). 30 Sep 1983. Contract FG07-81ID12221. 332p. NTIS, PC A15/MF A01. Order Number DE84003575.

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This alternative fuels study focuses primarily on the commercial feasibility of an improved, patented pyrolysis process producing 100,000 tons/year of a high Btu, low pollutant solid fuel (K-Fuel) in a proposed plant to be located in Burney, Shasta County, California, utilizing 400,000 tons/year of wood chips and forest residues from surrounding forests as feedstock. While there are significant uncertainties as to the commercial feasibility of the proposed Burney, California K-Fuel plant, application of the Federal Alter-

native Energy Production Credit appears to result in attractive internal rates of return. Assumptions made concerning these uncertainties remain to be proved, however, especially in the areas of: wood waste gathering systems and costs; Sacramento Valley and export customers; waste water organics and other possible environmental unknowns; demonstration that the proposed reactor design is capable of producing at least three tons per hour of saleable product; and burning characteristics of K-Fuel. The financial attractiveness of the K-Fuel process could be considerably better given different geographic sites and/or raw material than those targeted in this site specific study.

5829 **(DOE/R6/12086—T1) Alternate energy from farm related waste products: methane production and study of digested residue. Final report, July 1 - September 30, 1982.** Temple, H.W. (Wayland Baptist Univ., Plainview, TX (USA)). 1982. Contract FG46-81R612086. 34p. NTIS, PC A03/MF A01. Order Number DE84000050.

A local beef processing industry in the Plainview area produces about 100,000 pounds of waste materials per day from the slaughter of cattle. This material from the rumen is called paunch. Paunch material has been shown to produce methane or natural gas in large quantities. This study looked at production rates, digester design and optimum conditions for methane production in order to determine if the industry can profitably utilize paunch material as an alternate energy source. Bacterial studies were made and the evaluation of residue taken from the digester as a possible fertilizer was made. 6 references, 9 figures, 6 tables.

5830 **(EUR—7563-EN) Application of the anaerobic filter to biogas production from agricultural waste. Final report.** Colleran, E. (University Coll., Galway (Ireland)). 1983. 59p. ECIS, 2100 M St., NW, Suite 707, Washington, DC 20037.

This project was concerned with the anaerobic digestion of liquid and solid agricultural residues. The digester design chosen was the anaerobic filter which differs from the conventional design in having an inert holding matrix which retains the active biological flora. Flow is upward through the matrix and separation of the gaseous products from the liquid effluent occurs at the top of the filter column. Laboratory-scale filters were constructed and filled with a limestone matrix. Pig slurry supernatant, obtained by settling of fermented slurry, was digested in the filter with a high efficiency. A 9 m^3 pilot-scale reactor yielded similar results with COD removal rates of 90% and gas yields close to the theoretical maximum. Following laboratory trials, a second 9 m^3 filter was constructed for the anaerobic digestion of milk wastes. Over a 6 month trial period, the average COD reduction was 82% at a liquid retention time of 0.5 days and a temperature of 28 to 30°C. The effect of varying the filter matrix on the digestion efficiency was investigated at laboratory scale. A matrix of limestone chippings appeared to be slightly superior to either granite or phurnacite chips. When polystyrene particles were used as the matrix medium, very low COD removal rates were observed and the inhibition appeared to be specifically towards the acetogenic/methanogenic phase of digestion. In all laboratory filters examined, the bulk of the digestion process appeared to be completed within the lower 10cm of the digester, indicating that the remaining 90 cm may be largely superfluous. 18 references, 18 figures, 9 tables.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 6038, 6097, 6103, 6130

5831 **(DOE/AF/92502—T1) Conversion of navy bean canning plant wastes to ethanol. Final report.** McManus, W.E. (Delta Solar Systems, Blytheville, AR (USA)). [nd]. Contract FG46-81AF92502. 11p. NTIS, PC A02/MF A01. Order Number DE84003509.

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After the award of this grant we started work immediately in a self made, small laboratory. At the same time, samples of navy beans were sent out for analysis. Also, data was requested from different sources as to any research done on the production of alcohol from navy beans. (see report ending March 1981). As testing and data came in, we also started construction of the alcohol plant. As soon as the extruder was installed, tests were started using it as it was to be our cooking and starch conversion system. (see reports ending June, 1981 and September, 1981). Construction of the plant was completed and we were still having trouble getting conversion of starches from the waste stream (primarily navy beans and black-eyed peas). Mr. Howard from Homak, Inc. came to assist us with the extruder, but we could not get conversion as needed. (see report ending December, 1981). As a result of the inhibitor in the navy beans and black eyed peas, we were never able to get usable conversions of starch to sugar to make the project work. A copy of all quarterly reports and other pertinent information is included as the body of the final report.

5832 **(DOE/CE/50305—1) Progress in the production of ethanol from cellulose.** White, H.M. (Aerospace Corp., El Segundo, CA (USA). Mobile Systems Directorate). Jul 1983. Contract AC01-82CE50305. 42p. NTIS, PC A03/MF A01. Order Number DE84003597.

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A review was conducted of recently published material on the conversion of cellulosic materials to ethanol and other desired by-products. Attention focused on the hydrolysis of cellulose by acids and enzymes, since downstream steps to produce ethanol represent established commercial technology. However, some discussion of the fermentation of pentoses to useful products has been included inasmuch as such production utilizes microorganisms not previously employed in the chemical industry. Some important characteristics of several conversion processes for cellulose are presented. Discussion is presented under the headings: native cellulose characteristics; pretreatment technology; acid hydrolysis of cellulose; enzymatic processes; summary of current research; comparison of acid vs enzymatic hydroloysis; economic issues; environmental considerations; and assessment of cellulose-derived ethanol status. 45 references, 17 figures, 4 tables.

5833 **(DOE/CE/50305—2) Survey of current biomass gasification processes for methanol production.** White, H.M. (Aerospace Corp., El Segundo, CA (USA)). Jul 1983. Contract AC01-82CE50305. 32p. NTIS, PC A03/MF A01. Order Number DE84003928.

This report reviews the status of several biomass gasification processes capable of producing a synthesis gas for conversion to methanol. The overall process operations are presented but attention focuses on the gasifier itself. The main features of the various types are described, with emphasis on the principal technical problems areas that have been identified. In general, these problems relate to heat transfer, material, catalyst, and mechanical difficulties that have been encountered during development. Satisfactory solutions must be demonstrated on advanced, high performance gasifiers operated in large scale pilot facilities. Beyond these technical hurdles remains the obstacle of proving economical competitiveness with conventional methanol sources. 20 references, 10 figures, 7 tables.

5834 **(DOE/MI/01003—T1) Fundamentals of small-scale alcohol fuels production: a guide to assist minority farmers, producers, and educational institutions. Volume I .** (Trans Urban East Organization, New York (USA)). Oct 1982. Contract AC01-80MI01003. 168p. NTIS, PC A08/MF A01. Order Number DE84003653.

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This guide was prepared from materials obtained from various publications by the United States Government agencies and private sources involved in the area of alcohol fuels. The intent of this Guide is to fill an information void which currently exists among small, limited-resource minority farmers and farm cooperatives. This publication describes the processes involved in the production of alcohol; the markets available for distribution of the product/by-products; the use and suitability of alcohol as a fuel; the historical development of alcohol; and the new concept of Integrated Farm Systems as the future of the small-scale alcohol fuels industry. Special emphasis has been placed on the decision factors which are imperative to the consideration to produce alcohol. Worksheets, which help to determine the feasibility of alcohol production, are included, providing an opportunity for reviewing indi-

vidual needs. Tables, charts and diagrams summarizing vital information on alcohol production are interspersed throughout appropriate chapters and should be examined. 4 figures, 22 tables.

5835 **(DOE/PC/30019—T9) Liquid phase methanol process development unit: installation, operation, and support studies, draft annual report. Technical progress report No. 8, October 1, 1982-September 30, 1983.** (Air Products and Chemicals, Inc., Allentown, PA (USA); Chem Systems, Inc., Tarrytown, NY (USA)). 20 Oct 1983. Contract AC22-81PC30019. 404p. NTIS, PC A18/MF A01. Order Number DE84003108.

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Engineering of the 5 TPD LPMeOH PDU was completed, and significant progress was made at the LaPorte, TX site. The LaPorte installation work will be totally complete in mid-November 1983, and shakedown will begin as scheduled. Significant new data and results were achieved in the laboratory support programs at Fairfield and Allentown (APCI). Gas phase screening (0.5 inch tubular reactors) of new catalysts for liquid-entrained (slurry) operation was completed in Allentown. Investigation of some 25 new catalyst preparations led to the advancement of 3 catalyst candidates for liquid phase screening at Fairfield. The catalyst activity with both feed gases was stable, with long, slow deactivation observed (similar to Fairfield), an encouraging result. Laboratory progress at CSI, Fairfield was significant. Liquid phase screening of outside slurry catalyst candidates in the 2-liter stirred autoclave reactors was completed. Several outside catalyst powders achieved good performance in the liquid phase, and one commercial powder was recommended for advancement to LaPorte. In the fundamental modeling effort, the chemical equilibrium description for the methanol synthesis reaction was improved. Intrinsic kinetics were derived from the data from the stirred autoclave reactors. These kinetics were incorporated along with the gas holdup data into the three-phase backflow model of the liquid-entrained reactor. The model was subsequently used to make predictions of LaPorte performance, and to predict the data of the first Lab PDU slurry run. The early results are quite encouraging.

5836 **(DOE/R6/11995—T1) Small farm community operation of an alcohol distillation plant with recyclable low-grade waste heat capability. Final report.** Lowe, E.K. (ARK-o-hol Community Experiment Group, Scranton, AR (USA)). [nd]. Contract FG46-80R611995. 12p. NTIS, PC A02/MF A01. Order Number DE84003423.

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An energy-efficient distillation plant was designed to make possible a single-run process yielding 170 proof alcohol at 15 to 25 gallons per hour (the difference reflects the amount of heat applied to the base of the still and was varied to test making alcohol over a longer heat recycling time period). The distillation plant, an original design, was fabricated and constructed, and the site prepared for the alcohol operation. Heat exchangers in each distillation column section were electrically controlled to maintain a desired temperature for a molecular mixture at that point, drawing off as much as possible of the alcohol vapors and returning more and more water to the lower column. The low-grade waste heat in the return lines of the heat exchangers was plumbed to an in-ground heat storage tank in an adjacent greenhouse and circulated throughout the greenhouse by means of 7′ x 10′ floor plates (used reefer heat exchangers). To test the energy efficiency of the distillation plant, the Greenhouse was operated throughout an unpredictable winter with temperatures ranging from 85° to a low of 18°. No supplemental heat was used nor needed in the greenhouse, with the exception of daytime solar gain, and all plants survived to harvest in April 1983. Conversions of vehicles to operate on alcohol fuel was accomplished on various makes of farm-to-market vehicles by first tuning the vehicle for good gasoline operation, then boring out the carburetor jets, advancing the timing and increasing the compression ratio, etc. The 170 proof alcohol produced by this group proved sufficient for good alcohol coversions. All phases of site preparation, distillation plant design and construction, alcohol production process, etc. was performed by a farm community of 11 families.

5837 **(MTI/WDC—82TR506) Ethanol production utilizing waste heat. Submission of initial information. Task 2. Market study for fuel alcohol and by-products.** Hand, C. (Renewable Energy, Inc., Paducah, KY (USA)). Jan 1982. Contract FG05-81OR20808. 77p. NTIS, PC A05. Order Number DE84003884.

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The two purposes of this report are to provide initial information on the markets for the ethanol and by-products from the Paducah ethanol plant, and to provide initial unit revenue estimates for project feasibility calculations. The body of the report provides information related to the former purpose. This section provides the initial estimates on unit product revenues. Several applications are feasible for each of the products; ethanol and the by-products of distillers' grains and CO_2. The most studied application of the ethanol is as a gasoline blend. That for the distillers' grains is for a bulk animal feed. Projections for 25 years of unit revenues for these two applications are provided. For initial product estimates, these serve as the unit revenues. These are initial, incomplete estimates only. Further refinement requires more detailed study of the conditions in the Paducah area and the specifics of plant output. In addition, no product revenue estimates are provided for the CO_2. Some studies indicate that these revenues can make a contribution to plant income. However, the market and revenue potential are very site-specific. Further analysis, of conditions in the Paducah area, is needed to assess the revenue potential from the CO_2. 5 references, 3 figures, 17 tables.

5838 **(TENRAC/EDF—106) Preliminary evaluation of swine manure as alternative feedstock for the Del Valle Hog Farm fuel alcohol facility. Final report.** Smith, D.A.; Vinson, J.K. (SV and G Energy Resources, Inc., Austin, TX (USA)). Aug 1983. 26p. NTIS, PC A03/MF A01. Order Number DE84900431.

The purpose of this proejct was to investigate the use of swine manure as a feedstock for fuel alcohol plants. The project was conducted on the Del Valle Hog Farm and made use of the 24 gal/day fuel alcohol plant in operation there. The project involved the determination of the starch content of various samples of hog manure, and if an adequate source of starch was found, to use that manure as feedstock in full scale tests that would lead to a determination of the economic feasibility of such use. A full scale test consists of the conversion and fermentation of about 250 gallon batches of test feedstock. The production yield was determined by measurement of evolved gas during fermentation. The analysis of raw hog manure samples indicate that a good portion, about 19% by weight, of the dry matter is starch. The plant modifications required to operate with hog manure as feedstock appear to be reasonable and inexpensive. Full efficiency of conversion and fermentation was achieved with mash of about 4% solids concentration. However, with solids concentrations of 10% to 15%, the yeast died within a short time. A theory for the yeast deaths is that some yeast poison is present in the manure, and that it can be mitigated by dilution with water. Lab scale experiments confirm the dilution dependent behavior, however, no determination of the nature of the poison has been made. The study concludes that hog manure would be a viable feedstock if the yeast deaths can be prevented. The mash concentration could then be raised to 25% solids, and with screened manure of say 40% starch, the alcohol plant would work at 137% capacity with the same operating costs (acid, lime, yeast, but not heat) as with a batch of milo.

5839 **By-product inhibition effects of ethanolic fermentation by Saccharomyces cerevisiae.** Maiorella, B.; Blanch, H.W.; Wilke, C.R. (Lawrence Berkeley Lab, Univ California, Berkeley, California 94720; Dept of Chemical Engineering, Univ California, Berkeley, California 94720). *Biotechnology and Bioengineering;* **25**: No. 1, 103-121(Jan 1983).

From Symposium on fuels and chemicals from biomass; New York, NY, USA (26 Aug 1981).

Inhibition by secondary fermentation products may limit the ultimate productivity of new glucose to ethanol fermentation processes. New processes are under development whereby ethanol is selectively removed from the fermenting broth to eliminate ethanol inhibition effects. These processes can concentrate minor secondary

products to the point where they become toxic to the yeast. Vacuum fermentation selectively concentrates nonvolatile products in the fermentation broth. Membrane fermentation systems may concentrate large molecules which are sterically blocked from membrane transport. Extractive fermentation systems, employing nonpolar solvents, may concentrate small organic acids. By-product production rates and inhibition levels in continuous fermentation with Saccharomyces cerevisiae have been determined for acetaldehyde, glycerol, formic, lactic, and acetic acids, 1-propanol, 2-methyl-1-butanol, and 2,3- butanediol to assess the potential effects of these by-products on new fermentation processes. Mechanisms are proposed for the various inhibition effects observed. (Refs. 15).

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 5664, 5852, 6390

13 HYDRO ENERGY

1303 Plant Design And Operation

5840 (PB—83-246819) Site owner's manual for small scale hydropower development in New York State. Brown, R.S.; Goodman, A.S. (Polytechnic Inst. of New York, Brooklyn (USA)). Mar 1980. 185p. NTIS, PC A09/MF A01.

The manual is a New York State site-specific manual which includes: an introduction and overview of hydropower development; guidelines for assessing the capacity and energy offered by a site; procedures for making a preliminary estimate of development costs; economic and financing aspects of developing typical sites; and institutional and regulatory aspects that must be considered for successful site development. The manual will enable a site developer to determine when a potential project is feasible and will assist the developer in deciding whether a more costly, detailed professional feasibility study of the site is warranted. It is applicable to sites with or without dams and that have a potential electrical output of less than 15 megawatts.

14 SOLAR ENERGY

1401 Resources And Availability

5841 (N—8326356) Analysis of the solar radiation characteristics at Adrano. Barbaliscia, F.; Lavagnini, A. (Fondazione Ugo Bordoni, Rome (Italy)). May 1982. 65p. (In Italian). (FUB—12-1982). NTIS, PC A04/MF A01.

The distribution functions of solar radiation were determined using both a 30 sec base and a 10 to 60 min base. The data will be used for the design of a solar generator system at Adrano (Italy). Cumulative solar radiation by month, season and year was determined. The short and long term variabilities are discussed. It is shown that the measurements carried out on a 10 min base are practically equivalent to those from a 60 min base in determining the distribution function, while the shorter term measurements are not entirely equivalent. (ESA)

1404 Environmental, Legal, And Institutional Aspects

5842 (DOE/SF/10501—302) Wildlife interactions at Solar One facility, Daggett, California: Fall 1982 interim report. Wagner, W.D.; McKernan, R.L.; Flanagan, P.A.; Schreiber, R.W. (Natural History Museum Foundation, Los Angeles, CA (USA). Section of Ornithology). Sep 1983. Contract FC03-77SF10501. 33p. (STMPO—603). NTIS, PC A03/MF A01. Order Number DE84002391.

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Data are summarized that were collected from mid-September through November, 1982 to determine the effects of Solar One on Wildlife, particularly as regards the insect and bird populations. Bird mortality was found to be chiefly caused by collisions with heliostats, rather than by incineration. (LEW)

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 5828, 5830, 5831, 5832, 5833, 5834, 5836, 5837, 5838, 5839, 6070, 6390

5843 (DOE/JPL/954739—83/5) Study program for encapsulation materials interface for flat-plate solar array. Annual report, January 1, 1981-December 31, 1981. Kaelble, D.H.; Mansfeld, F.B.; Kendig, M. (Rockwell International Corp., Thousand Oaks, CA (USA). Science Center). Feb 1982. Contract NAS-7-100-954739. 112p. NTIS, PC A06/MF A01. Order Number DE84003566.

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The early validation of a 20 year service integrity for the bonded interface in solar sell modules is an important requirement in the Low Cost Solar Array (LSA) project. In the present fifth phase of study summarized here emphasis is placed on the development of materials selection criteria for encapsulant bond integrity and more fully validating AC impedance methods for detecting early electrical malfunction in solar modules.

5844 (DOE/JPL/955533—83/7) Development of a polysilicon process based on chemical vapor deposition (Phase 1 and Phase 2). Final report, 6 October 1979-25 June 1982. Plahutnik, F.; Arvidson, A.; Sawyer, D.; Sharp, K. (Hemlock Semiconductor Corp., MI (USA)). Aug 1982. Contract NAS-7-100-955533. 148p. NTIS, PC A07/MF A01. Order Number DE84004975.

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The goal of this program was to demonstrate that a dichlorosilane based reductive chemical vapor deposition (CVD) process is capable of producing a high-purity, low-cost polycrystalline silicon. Physical form and purity of this material was to be consistent with FSA material requirements for manufacturing high efficiency solar cells. The feasibility phase (Phase 1) provided information through laboratory experiments relating to the kinetics of trichlorosilane redistribution, catalyst behavior, and decomposition characteristics of dichlorosilane. Of particular importance, Dowex MWA-1 was shown to be an effective redistribution catalyst at moderate temperatures and very few reactor related operational problems were observed during dichlorosilane decomposition. The demonstration phase (Phase 2) evaluated technology developed during Phase 1 at a dichlorosilane production and decomposition scale sufficient to allow scale-up for the Experimental Process System Development Unit (EPSDU). Catalyst life, polysilicon deposition rate, and product purity were established as acceptable in addition to defining process limitations. An economic analysis was completed for a 1000 metric ton per year commercial facility using Hemlock Semiconductor's Polysilicon Process Based On Chemical Vapor Deposition. This analysis indicated that polycrystalline silicon of semiconductor quality could be produced at a price of $20.27 per kilogram.

5845 (INIS-BR—78, pp 41) Production of fungal protein from photochemically pre-treated lignin cellulose. Gomez, E.; Toledo, S.M. de; Mansilla, H.; Duran, N. (Universidade Estadual de Campinas (Brazil). Inst. de Quimica). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

5846 (LBL—16785) Fundamental mathematical principles for electrochemical engineering. Newman, J. (Lawrence Berkeley Lab., CA (USA)). Aug 1983. Contract AC03-76SF00098. 18p. (CONF-830859—10). NTIS, PC A02/MF A01. Order Number DE84002181.

From National meeting of the American Institute of Chemical Engineers; Denver, CO, USA (28 Aug 1983).

Exceedingly complex processes can now be subjected to reasonably realistic analysis and simulation. Electrochemical processes qualify as complex because of the diverse chemistry involved and

the presence of electrical variables. Consequently, we should get on with the job of modeling so that we can simulate electrochemical systems with a completeness and realism comparable to what is found in the simulation of distillation columns. In this paper we intend to expound on the philosophy of such simulation and to reiterate some of the governing mathematical basis for the physical and chemical processes with which we expect to deal. Examples will be mentioned in order to maintain some flavor of current research problems. These include the use of semiconductor electrodes in a photoelectrochemical cell, the design of LiAl-FeS cells for electrical energy storage, and the growth of a salt film in the corrosion of iron.

5847 **(N—8326313) Study of internal stresses of thin solar cell modules. Final Report.** Zimmermann, K.J.; Haeverli, U. (Aerospace Engineering Office, Zurich (Switzerland)). Jun 1982. 49p. (REPT—37-155/NT; ESA-CR(P)—1696). NTIS, PC A03/MF A01.

Three solar cell computer programs were converted from MARC into NASTRAN. The meshes were generated by the AEO interactive SIMP package. The results of these conversions were compared with test results. The computer programs used to compute the interconnector and wiring stresses were implemented into SIMP. By applying fatigue properties of solar cell interconnectors, the life cycle can be determined using thermal distortion results of the solar cell modules. It is shown that the computation of the module internal stresses can be performed within a few days and at a lower cost than the previous analysis steps.

5848 **(N—8326314) Validation of solar collector measurements under natural and simulated conditions.** Ley, W. (European Space Agency, 75 - Paris (France)). Feb 1983. 202p. (ESA-TT—775; DFVLR-FB—82-05). NTIS, PC A10/MF A01.

Original report in German; previously announced as N82-32891.

The performance characteristics, heat losses, azimuthal angular dependence and effects of different environmental parameters were determined for low temperature flat plate solar collectors, under natural and simulated conditions. Results indicate that outdoor tests can be replaced by indoor measurements, using a simplified solar simulator and a climatic chamber.

5849 **(N—8327366) Performance and sputtering criteria of modern architectural glass coatings.** Nunz, W.D.; Reineck, S.R. (Leybold-Heraeus G.m.b.H. und Co. K.G., Hanau (Germany, F.R.)). Jul 1982. 10p. (CONF-820107—(Pt.1)). NTIS, PC A06/MF A01.

From SPIE optical coatings for energy efficiency and solar applications conference; Los Angeles, CA, USA (25 Jan 1982).

In Transparent Heat-Mirror Mater. and Deposition Technol., p 61-70 (SEE N83-27357 16-44).

The specific requirements to the magnetron cathode to reach special film properties are described. For the solar control films a low magnetic field strength version of the magnetron cathode is used to improve film hardness. For the heat mirror coatings a high magnetic field strength version of the magnetron cathode is described, especially to prevent the oxidation of IR-reflecting intermediate metal film. Optical values of solar control films on the base of stainless steel and titanium are given. Special color effects, especially in reflection are described. Heat mirrors are exhibited as three films systems with silver or copper as the intermediate metal films. Transmission and reflectivity values are reported.

5850 **(PB—83-242156) Erstellung und tests von experimental-solargeneratoren fuer konzentrierende systeme (fabrication and tests of experimental solar generators for concentrating sunlight systems). Final report.** Gochermann, H.; Muehle, H.; Schmidt, E. (Commission of the European Communities, Luxembourg). [nd]. 37p. (EUR—8149-DE). NTIS, PC E03/MF E03.

Based on the results of fundamental research on silicon solar cells for concentrated sunlight, the design, development and fabrication of terrestrial, photovoltaic experimental generators suitable for integration into a hybrid system are described.

5851 **(PB—83-248864) Integrated thin film solar cell generators with higher output voltages. Final report 1 January 1978-30 June 1980.** Bloss, W.H.; Hewig, H. (Commission of the European Communities, Luxembourg). [nd]. 62p. (EUR—8160-EN). NTIS, PC E04/MF E04.

A technology for the production of large-area integrated Cu/sub x/S-CdS thin-film solar cell generators with enhanced output voltages has been developed. The CdS-layers are produced by evaporating CdS-powder and are comparable in quality with vacuum-deposited CdS-layers. For the production of the Cu/sub x/S-layers two modifications of the Clevite wet process gave good results: (a) by dipping the cells in a Cu+-ion solution and (b) by spraying the Cu+-ion solution on to rotating CdS substrates. A glass sheet with an integrating Au-plated copper grid serves for front-contact encapsulation.

5852 **(PB—83-252122) Wood-fired steam production at Clarkson College of Technology. Final report.** Lin, F.B. (Clarkson Coll. of Tech., Potsdam, NY (USA)). Sep 1982. 82p. NTIS, PC A05/MF A01.

The report details the results of the first year of operation of a wood-fired steam system installed at Clarkson College. The system is designed to burn wood chips to produce up to 10,000 lb/hr. of steam at 150 psig. The report includes descriptions of the contracting process for equipment and wood fuel, equipment specifications and costs, and the physical layout of the equipment. The operating experience for the first heating season is outlined and the economic impact of the system is analyzed in the report. To assist others who are considering wood conversions, the report also projects the economic benefits of similar systems and details equations which can be used in conducting project-specific analyses.

5853 **(SAND—83-1144) Photovoltaic concentrator research project. Eleventh project integration meeting, December 13-14, 1983, Albuquerque, NM.** (Sandia National Labs., Albuquerque, NM (USA)). Dec 1983. Contract AC04-76DP00789. 244p. NTIS, PC A11/MF A01. Order Number DE84003250.

This report is the Proceedings for a meeting on photovoltaic concentrator research held at Albuquerque, NM in December 1983. The meeting covered research on photovoltaic concentrators and their components, including concentrator cells, cell assemblies and receivers, fresnel lenses, concentrator modules, tracking structures and control systems, and complete concentrator arrays. This report contains abstracts and summaries of presentations made at the meeting, and status reports for current research contracts in this area.

5854 **(SAND—83-2417C) Study of thermal fatigue of soldered photovoltaic cells by thermal resistance measurement.** Roth, E.P. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 11p. (CONF-831248—1). NTIS, PC A02/MF A01. Order Number DE84003764.

From 11. DOE/SNLA photovoltaic concentrator project integration meeting; Albuquerque, NM, USA (13 Dec 1983).

The solder layers used to attach concentrator photovoltaic cells to electrical leads and heat sink substrates have experienced failure after various periods of thermal cycling. In order to determine the degree of solder joint failure as a function of temperature and time, a study was initiated to measure the degree of solder debonding after a schedule of controlled thermal cycles. The cells were Sandia First Generation baseline cells assembled by G.E. as shown in Fig. 1. The degree of debonding was determined by measuring the thermal resistance of the cell-substrate-heat sink stack using a testing device constructed at Sandia Labs as shown in Fig. 2. The cell contributions to the stack resistance are shown in Table I. The thermal resistance was determined by measuring the cell temperature rise resulting from the passage of a large DC electrical current through the cell. The temperature rise was determined by first calibrating the dark forward voltage of the cell as a function of temperature and then measuring the change in this voltage as a function of time after the removal of the electrical heating current (Fig. 3).

5855 **(TENRAC/EDF—113) Maximizing biomass production in semi-arid regions: genotypic selection of identified species.** Goodin, J.R.; Newton, R.J. (Texas Tech Univ., Lubbock (USA); Texas A and M Univ., College Station (USA)). 31 Aug 1983. 26p. NTIS, PC A03/MF A01. Order Number DE84900426.

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This project identifies genotypes selected from two species of unconventional plants previously identified as having exceptional potential for the production of biomass feedstock in semi-arid regions. The project involved collection of germ plasm from indigenous Atriplex canescens (saltbush) and introduced Sorghum halepense (Johnson grass). In addition, greenhouse and field screening techniques recently aplied to domesticated crop plants are used to identify exceptional biomass productivity based on drought tolerance, salinity tolerance, and seedling vigor. In both of these species, the genetic base is enormous. Saltbush is common to all of western North America, and Johnsongrass had established itself as an important forage and weedy species throughout most of the world. It would appear that artificial selection for desirable genotypes is a feasible process, and this project has demonstrated the possibility of selection from many accessions from the field. Preliminary screening for seedling vigor, drought tolerance, and salt tolerance has produced a few genotypes now ready for field testing. Propagation of these cloned genotypes is underway. 22 references, 2 figures, 1 table.

1406 Photovoltaic Power Systems

5856 **(DOE/ET/20628—2) Phase III initial operation and subjective evaluation 100-kilowatt, Lovington Square shopping center, photovoltaic project, March 17, 1981-April 30, 1982.** (New Mexico Solar Energy Inst., Las Cruces (USA)). Oct 1983. Contract AC04-79ET20628. 41p. NTIS, PC A03/MF A01. Order Number DE84003037.

This report presents the results of the first year of operation of a 100 kilowatt flat-plate photovoltaic system at Lovington, New Mexico. Program management was the responsibility of the Albuquerque Office of the Department of Energy (DOE/AL). Technical assistance to DOE/AL was provided by Sandia National Laboratories, Albuquerque, New Mexico.

5857 **(DOE/R6/10967—T1) Livestock water pumping using solar energy.** Feller, D.W. (Feller (Dennis Werner), Fredericksburg, TX (USA)). [nd]. Contract FG46-79R610967. 9p. NTIS, PC A02. Order Number DE84003502.

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The solar livestock water pumping system has been installed and operated for over a month. The system is working well and has been providing the livestock water for a month. This report presents an as-built block diagram of the system and also summarizes the difficulties encountered in designing and installing the system. The cost of the system is slightly less than estimated primarily due to the fact that the labor required to install the system was less than anticipated.

5858 **(SAND—83-7093C) Operational behavior of line-commutated photovoltaic systems on a distribution feeder.** Ong, C.M. (Purdue Univ., Lafayette, IN (USA). School of Electrical Engineering). 1984. Contract AC04-76DP00789. 9p. (CONF-840110—1). NTIS, PC A02/MF A01. Order Number DE83011789.

From IEEE conference on power apparatus and systems; New York, NY, USA (1 Jan 1984).

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A study of the operational behavior of line-commutated inverter photovoltaic systems on a distribution feeder has been conducted using a detailed three-phase representation. This paper summarized and discussed the results obtained on the dynamic response of the photovoltaic systems to operating point changes, to load and line switchings, and to faults on the ac system. The paper also characterized the harmonics generated by such systems operating under unbalanced voltage and network impedance conditions, and examined the interaction between the inverter and the torsional modes of oscillations of nearby synchronous motor loads.

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 5842

5859 **(DOE/R6/12016—T1) Solar irrigation pump project. Final report on the design, fabrication and testing of a prototype.** Price, M. (Price (Michael), Socorro, NM (USA)). Jan 1982. Contract FG46-80R612016. 26p. NTIS, PC A03/MF A01. Order Number DE84003116.

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A small inexpensive solar water pump would be of obvious benefit to gardeners. The object of this effort was to build and test a prototype of such a pump. In the evaluation of the prototype, a thermodynamic model of a species of solar engine was developed and refined. This model becomes a powerful tool in the search for the optimum design of a practical pump.

5860 **(DOE/SF/10501—301) Wildlife interactions at Solar One facility, Daggett, California: Spring 1982 interim report.** McKernan, R.L.; Flanagan, P.A.; Schreiber, R.W. (Southern California Edison Co., Rosemead (USA)). Oct 1982. Contract FC03-77SF10501. 22p. (STMPO—091). NTIS, PC A02/MF A01. Order Number DE84002396.

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Solar One incinerated large numbers of insects during certain periods, but to date, bird mortality seems very low and does not warrant major concern regarding spring migrants. During spring 1982, 5.6 birds/month were found incinerated or killed due to collisions with plant structures. The 18 day census period coincided with peak migration in this region and constitutes a worst-case situation for this season. Wildlife impacts other than initial plant construction in general were not considered biologically important at this central receiver solar plant during this study. At Solar One, the major attractant for avian species are the evaporation water impoundments and the agricultural areas and not the facility itself. These two agricultural habitats create a unique effect in the desert by offering transient species suitable areas for loafing. Therefore, by reducing development of these artificial areas at future solar facilities, the potential avian impacts could possibly be minimized. A fall and winter study is currently being conducted to assess effects of avian use during these two seasons.

5861 **(DOE/SF/11921—T1) Solar thermal research workshop. Final report.** Lefferdo, J.M. (Georgia Inst. of Tech., Atlanta (USA)). 7 Nov 1983. Contract AC03-83SF11921. 9p. NTIS, PC A02/MF A01. Order Number DE84002733.

The Solar Thermal Research Workshop was held on the Georgia Tech campus on September 7-8, 1983. The two-day, four-session agenda is shown. The speakers and topics were chosen by a workshop steering group in July. The panel session, participants who were also selected by the steering group committee, followed the last formal presentation session. The panel session summary provides a succinct assessment of the panel and workshop participant viewpoints of the solar thermal research program. The summary comments are comprised of panel summaries as well as workshop attendee floor statements. Some comments represent general workshop viewpoints based upon the elaboration of discussion that followed. Three comments have been selected as representative of the panel session. It was generally agreed that this type of peer review was valuable and should occur at least annually; research cannot be effectively focussed on day-by-day industrial needs, but at the same time a stronger link must be established between researchers and industry; more definitive goals must be set to focus the program.

5862 **(EUR—8743-FR) Development of a free-piston Rankine cycle refrigerating machine.** Vokaer, D.P.; Vandendael, Y. (Universite Libre de Bruxelles (Belgium)). 1983. 83p. (In French). European Community Information Service (ECIS), 2100 M Street, N.W., Suite 707, Washington, DC 20037.

The research deals with a free piston refrigerating machine supplying a net output of 3 kW at 10°C, with 25°C ambient, driven by solar heat at low temperature: 70°C. The previous contract led

to the design of a prototype which is to be comprehensively studied in order to bring the necessary improvements and to refine the modelling computer programmes. Dynamic tests are performed with compressed air as the driving fluid, in order to insure that the machine actually can work. The following fields are investigated: frictions losses due to piston rings; internal leakages in the distributor and between the machine chambers; pressure drops; refinement of computer programmes; and study of the distributor. The above facts being established, the decision is made to abandon the previous distributing valve and replace it by an electric one, controlled by two proximity inductive transducers detecting a particular piston position at both sides of its stroke.

5863 **(SAND—83-1631C) Sodium heat transfer system modeling.** Baker, A.F.; Fewell, M.E. (Sandia National Labs., Livermore, CA (USA); Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 6p. (CONF-831111—9). NTIS, PC A02/MF A01. Order Number DE84002051.

From ASME winter annual meeting; Boston, MA, USA (13 Nov 1983).

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The sodium heat transfer system of the International Energy Agency (IEA) Small Solar Power Systems (SSPS) Central Receiver System (CRS), which includes the heliostat field, receiver, hot and cold storage vessels, and sodium/water steam generator has been modeled. The computer code SOLTES (Simulator of Large Thermal Energy Systems), developed by Sandia National Laboratories, was used to model this system. Based on data provided to Sandia by the IEA-SSPS/CRS project, the results from SOLTES are compared to measured data. The comparison between measured data and predictions from SOLTES is very good for the day evaluated.

5864 **(SERI/TP—252-2105) High-temperature direct absorption research.** Copeland, R.J. (Solar Energy Research Inst., Golden, CO (USA)). Oct 1983. Contract AC02-83CH10093. 8p. (CONF-830990—3). NTIS, PC A02/MF A01. Order Number DE84000019.

From Solar thermal research workshop; Atlanta, GA, USA (7 Sep 1983).

The Solar Energy Research Institute (SRERI) is conducting research for high-temperature solar thermal receivers. A molten salt can serve as both the receiver heat transport and the thermal storage medium. Molten carbonates are the primary candidate salts for applications requiring temperatures of 850°C (1562°F) or higher. The receiver absorbs concentrated solar radiation directly on a salt film flowing down a wall in a cavity. This research has shown that depending on the receiver design, laminar, transition, or turbulent flow may be present. The heat transfer characteristics depend on both the optical properties and the film thickness. Predictions of molten-salt film thickness indicate a substantial variation in film thickness between flow regimes. A device has been constructed that can be used to verify the predictions and to provide data at low temperatures where none currently exist. Mathematical models of the heat transfer process in clear and blackened salts have been developed for both laminar and turbulent flow regimes. Blackened salts are preferred, but clear salts can also be employed.

1408 Ocean Energy Systems

REFER ALSO TO CITATION(S) 6737

5865 **(DOE/ET/21099—T2) OTEC Utility Users Council. Final grant termination report, second year activities.** (Puerto Rico Electric Power Authority, San Juan). Sep 1982. Contract FG01-80ET21099. 7p. NTIS, PC A02/MF A01. Order Number DE84001609.

The second year of the activities of the OTEC Utility Users Council is reported, including meetings and a statement on the DOE OTEC Pilot Plant. (LEW)

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 6067, 6070

5866 **(CONF-830990—5) Direct flux solar chemical reactors.** Yudow, B.D. (Institute of Gas Technology, Chicago, IL (USA)). 1983. 15p. IGT, 3424 South State Street, IIT Center, Chicago, IL 60616.

From Solar thermal research workshop; Atlanta, GA, USA (7 Sep 1983).

The objective of the project reported was to determine the technical feasibility and practicality of developing commercial-scale direct flux solar chemical reactors. In a direct flux reactor, reaction heat can be supplied by any single source or combination of sources among direct solar radiation, reflected solar radiation, and reradiant solar energy from hot surfaces within the reactor. The reactor must have no opaque heat transfer surfaces. Central receivers are the only heat source considered appropriate for large-scale chemical processing. Two reactions are examined - calcination of limestone and steam reforming. Conceptual designs were developed around these reactions. (LEW)

5867 (CONF-8206130—, pp 331-340) **Applications experience: the Brookhaven House.** Pietz, P.F. (Equinox, Inc., Peterborough, NH). Aug 1983. NTIS, PC A21/MF A01.

From Building thermal mass seminar; Knoxville, TN, USA (2 Jun 1982).

The residential application of thermal mass represented by The Brookhaven House, a residential demonstration project at Brookhaven National Laboratory is described. The house is a 2000 square foot, well-insulated, three bedroom, one and one-half bath solar home utilizing direct gain, sunspace, and Trombe wall passive systems. The thermal mass location, material choices, and construction experience are described.

5868 (CONF-8206130—, pp 341-352) **DOE passive solar commercial buildings program.** Gordon, H.T. (Burt Hill Kosar Rittelmann Associates, Washington, DC). Aug 1983. NTIS, PC A21/MF A01.

From Building thermal mass seminar; Knoxville, TN, USA (2 Jun 1982).

The Passive Solar Commercial Buildings Design Assistance Program is funding the design and construction of passive solar features for 23 commercial buildings nationwide. When complete, they will represent the largest unified data base of passive commercial buildings to date. Burt Hill Kosar Rittelmann Associates is serving as a support contractor to DOE, with the responsibility of assembling and analyzing project data as it becomes available. Several projects have now completed construction and submitted final documentation. This information has provided new indications concerning the technical as well as economic competitiveness of passive techniques in commercial buildings.

5869 **(DOE/CS/31509—T1) Solar energy project in South Dakota with active solar heating systems. Final report.** (Spearfish School District, SD (USA)). Feb 1979. Contract FC03-77CS31509. 170p. NTIS MF A01. Order Number DE84001119.

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The new Spearfish High School solar air energy system was built in 1978 and consists of a high volume flatplate (Solaron, Inc.) collector array of 8034 square feet mounted at 55 degree tilt facing due south, operated by a circulating fan on the outlet duct return to the storage air handler. Upstream of the storage rock bin, capacity 4150 cubic feet, is a damper system which selects solar heated air flow to a DHW preheat heat exchanger (36 inches x 68 inches), directly to the space heating load; or to the rock bin for storage. Auxiliary energy for space and hot water heating is provided by natural gas fired packaged boilers. The system, shown schematically, has three modes of operation for space heating: Mode 1 - Collector-to-Storage; Mode 2 - Collector-to-Space Heating; and Mode 3 - Collector-to-Space Heating and Storage. Included in this report are: pictures of installation, acceptance test plan and results; operation and maintenance manual; updated operational performance

data; updated abstract and narrative; updated as-built blue prints; and major construction and maintenance problems encountered and recommendations.

5870 **(DOE/CS/32150—T1) Jamestown College sports building solar system SHAC No. 1150. Final report.** Dekrey, D. (Lightowler Johnson Associates, Inc., Fargo, ND (USA)). 8 Nov 1983. Contract FC03-78CS32150. 246p. NTIS, PC A11/MF A01. Order Number DE84002241.

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Jamestown College is a small private college located in central North Dakota. High fuel prices combined with severe winter conditions make inexpensive alternate fuel sources attractive. The selection of Jamestown College as the site for a Solar Heating and Cooling Demonstration Project was therefore met with a great heat of enthusiasm. The system consists of 198 ground-mounted, liquid, flat plate collectors and a 10,000 gallon storage tank for heat storage. Heat is collected by circulating a 50% water, 50% ethylene-glycol solution through the solar panels. A heat exchanger transfers the heat from the ethylene-glycol solution to water stored in the 10,000 gallon underground storage tank. The water in the storage tank is used throughout the building for heating purposes. This system can store heat in excess of building demands for use during nonsolar conditions. The system supplies supplementary building heat, domestic hot water preheat and supplementary swimming pool heat. Included in this report are: general system description; acceptance testing; acceptance test plan; operation and maintenance manual; maintenance and inspection schedule; and manufacturers literature.

5871 **(DOE/CS/32391—T1) Space- and water-heating solar system for field house. Final report.** (Louisiana State Univ. and Agricultural and Mechanical Coll., Baton Rouge (USA)). Sep 1978. Contract AC03-76CS32391. 21p. NTIS, PC A02/MF A01. Order Number DE84002444.

An active space and water heating system for a university field house is described, and consists of 309 collectors with a total surface area of 5,560 square feet, a domestic hot water heating system consisting of two separate subsystems serving separate wings, a space heating system consisting of separate sub-systems for combination heating and cooling, a storage tank, and automatic controls. The system is described, as well as its site data acquasition system, system construction is reported, and acceptance test plan is outlined. (LEW)

5872 **(DOE/CS/32398—T1) El Camino Real Elementary School solar project, Irvine Unified School District. Final report.** (Irvine Unified Schools, CA (USA)). 3 Oct 1983. Contract AC01-76CS32398. 131p. NTIS, PC A07/MF A01. Order Number DE84001025.

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The El Camino Real School (sometimes referred to as the Irvine School) is approximately 10 miles from the Pacific Ocean, and was built in 1971. The building contains 41,109 square feet of floor area, and is normally occupied five days a week by 850 children and 60 adults. A solar energy system was added to the existing building, and was designed to supply 50% of the annual building heating and cooling demand. Since heating demands are low due to the moderate climate and most of the load demand occurs during the day, no solar energy storage is provided. The 4950 square feet of Owens-Illinois evacuated tubular glass collectors face south at a 25° angle to the horizontal. The collector modules consist of 24 tubes, 12 up and 12 down in a series flow arrangement. The modules are piped in reverse return with insulated steel branch piping. Included in this report are the following: executive summary; site and building description; solar system description; report to Board of Education (1977); transmittal letter describing refurbishment; acceptance test report; solar collector manual; and as-built drawings.

5873 **(DOE/R6/12002—T1) Solar heating system for Alexandria Arts and Crafts Center, Alexandria, Louisiana. Final technical report.** (Barron, Heinberg and Brocato, Alexandria, LA (USA)). Aug 1983. Contract FG46-80R612002. 13p. NTIS, PC A02/MF A01. Order Number DE84003122.

The Yeager Building was originally a two-story office building that has been renovated to a studio type building for artists, craftsmen, etc. All existing mechanical systems were removed, and three new gas fired split systems were installed to heat and cool the building. The first floor of the building consists primarily of studios and corridor space and is served by one air conditioning unit (11 rows cooling and 107,000 BTUH heating). The heating is assisted by a hot water heating coil (45,000 BTUH) in the supply duct which derives its energy from solar collectors mounted on the roof. The solar system also preheats the incoming domestic water before it enters the domestic water heater. The solar system was installed as indicated on the plans and specifications.

5874 **(DOE/R6/12007—T1) Solar home heating and cooling systems.** Woodhouse, R.P. (Woodhouse (Robert P.), Slidell, LA (USA)). [nd]. Contract FG46-80R612007. 6p. NTIS, PC A02/MF A01. Order Number DE84003233.

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This project is an active solar home heating and potable hot water system and a home cooling system using well water. Implementing existing technology, an average homeowner can construct such a system using off-the-shelf components. These components include materials needed for solar collectors, heat exchanger, water pumps, storage tank, piping and controls to make the system completely automatic. The materials are readily available at local lumber yards, hardware stores and plumbing supply stores and the components are relatively simple to install. Estimated utility reduction is 65% in a properly insulated home. Life expectancy of the system is in excess of twenty years with very little maintenance costs necessary. Costs and comparisons will be kept to illustrate savings to potential users.

5875 **(DOE/R6/12034—T1) Adapting poultry production to solar heat.** (Reed (Leighton B.), Kansas, OK (USA)). 15 Dec 1982. Contract FG46-81R612034. 57p. NTIS, PC A04/MF A01. Order Number DE84003129.

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During 1982 a floor heating system has been installed in a 40 ft. x 300 ft. chicken house (15,000 birds). The floor heating system consists of EPDM synthetic rubber tubing buried in a 4-inch concrete slab. Hot water is supplied to the tubing from a 4000 gallon storage tank which is insulated and buried outside the chicken house. The storage tank is heated by 24 solar collectors which are ground mounted on the south side of the chicken house. A propane fired boiler is in line between the storage tank and the floor. The boiler adds heat to the water entering the floor if the water is not hot enough.

5876 **(DOE/R6/12332—T1) Passive solar addition to therapeutic pre-school. Final technical report.** (Peanut Butter and Jelly Therapeutic Pre-School, Albuquerque, NM (USA)). Oct 1983. Contract FG46-81R612332. 23p. NTIS, PC A02/MF A01. Order Number DE84003501.

This project consisted of designing and constructing a passive solar system on a new classroom addition to the Peanut Butter and Jelly Therapeutic Pre-School in Albuquerque, NM. The purpose of this project was to demonstrate the applicability of solar space heating systems to large institutional buildings, and to demonstrate the energy and cost savings available through the use of such systems. Preliminary estimates indicated that the passive solar systems will provide about 90 percent of the heating and cooling needs for the new classroom addition to the school.

5877 **(FSEC-CR—93-83) Handbook for designing ventilated buildings. Final report.** Chandra, S.; Fairey, P.; Houston, M. (Florida Solar Energy Center, Cape Canaveral (USA)). 23 Sep 1983. Contract AC03-80SF11510. 79p. NTIS, PC A05/MF A01. Order Number DE84000636.

The principles of airflow in and around buildings are briefly reviewed, including ventilation in rooms with windows in only one wall, ventilation augmentation by wingwalls, whole house roof ventilators, and the effects of grouping buildings, trees and landscaping, and insect screenings. Window design is briefly discussed, followed by design guidelines for naturally ventilated homes and some example home plans. Whole house fans are also discussed briefly. A design procedure is included to size windows for naturally ventilated rooms. (LEW)

5878 **(NP—4900199) Passive-solar and low-energy building design. Residential Conservation Demonstration Project. Final report.** Doering, R.D. (University of Central Florida, Orlando (USA). Coll. of Engineering; Florida Solar Energy Center, Cape Canaveral (USA)). Oct 1982. 269p. NTIS, PC A12/MF A01. Order Number DE84900199.

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This project demonstrated the potential of selected passive solar design techniques for reducing the electrical power consumption of typical Florida residences. Six existing residences in the Central Florida area were selected and retrofitted by standard architectural and construction practices to permit them to be more efficiently air conditioned within the Florida environment. Each residence was studied to determine which energy saving concept would be most appropriate and cost effective relative to its architecture and construction details. The primary concepts included vented skin walls and roofs, exterior wall insulation, radiant barrier roof, and attic ridge vents. Each residence was also equipped with an instrumentation system to monitor and record, at 15-minute intervals, temperature data and power consumption. One residence was also equipped to record ground and ambient temperatures, ambient relative humidity and solar insolation. Other data collected included the resident's response to the architectural modification, their life style and historical power consumption. Each energy conservation design was also tested at the Florida Solar Energy Center in the Passive Cooling Laboratory. This involved installation and instrumentation of each wall/roof design in the building and collection of temperature, radiation, humidity and heat flow data under controlled conditions. The results of the two studies were correlated using a thermal resistance-capacitance network model. The results showed the most cost effective wall treatment was the vented skin design followed by exterior insulation. On the roof, the radiant barrier was most effective, followed by the vented skin-ridge vent treatment. The cooling season performance for the field residences showed a high savings of 37% with an overall average of 13% of the total residence monthly power billing.

5879 **(SERI/STR—254-2085) Documentation of data processing procedures and extension of class B data analysis. Final subcontract report.** Shea, M.; Mort, D.; Mahajan, S.; Newcomb, C. (Sierra Energy and Acoustics Consultants, Sacramento, CA (USA)). Sep 1983. Contract AC02-77CH00178. 169p. NTIS, PC A08/MF A01. Order Number DE84000021.

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This report discusses in detail, and supplements the material presented in, an original report by the California Energy Commission on the performance of eleven Class B passive solar homes in California. A description and an example of the procedure used to process data on-site is presented. The complete step-by-step procedure that was used in California to analyze the data and extract the various performance parameters is presented with at least one example for each step. Problems and solutions of data transfer and analysis are given in detail. The processes used to measure the infiltration loss coefficient, the conduction loss coefficient of the envelope, and the furnace efficiencies are presented. An attempt is made to extend the analysis of Class B data to answer some of the why questions of performance. The purpose of this report is to document ways to improve the quality and usefulness of the Class B data collected and to help future Class B monitoring data better meet the need of end users.

5880 **A simple method for estimating heating and cooling performance of buildings having multiple passive or hybrid features.** Carroll, J.A. (Energy Science Laboratories, San Diego, CA). pp 147-151 of Progress in passive solar energy systems. Hayes, J.; Winn, C.B. (eds.). New York, NY; American Solar Energy Society (1982). (CONF-820819—).

From 7. national passive solar conference; Knoxville, TN, USA (30 Aug 1982).

This paper describes a simple method of estimating the seasonal heating and cooling performance of buildings containing one or more passive or hybrid features. The calculations can be done by hand, and they agree closely with detailed computer simulations. This method has many advantages over currently used methods: (1) it estimates sensible cooling loads as well as heating loads, (2) hybrid hydronic heating and cooling of slab floors can be modeled, (3) it can be used with multiple solar apertures of arbitrary orientation, (4) interactions between conservation and solar features are included, (5) interactions of direct gain, Trombe wall, and hybrid systems are handled, (6) calculations are seasonal (only 2 sets needed) rather than monthly, (7) comfort impacts of features such as thermal mass are included. This method was developed as a compliance tool for a performance-oriented building code for San Diego County (1000-4000 HDD; 800-3000 CDD). In such an application, accuracy is less important than an ability to handle a variety of features. However, the derivation of this method does guarantee accuracy for cases near the baseline, and it was found that the method also agrees very well with the simulations for cases far from the baseline.

5881 **Design, construction, and performance of a passive solar retrofit.** Healey, H.M. (Tennessee Valley Authority, Chattanooga); Pardue, E.K. pp 215-220 of Progress in passive solar energy systems. Hayes, J.; Winn, C.B. (eds.). New York, NY; American Solar Energy Society (1982). (CONF-820819—).

From 7. national passive solar conference; Knoxville, TN, USA (30 Aug 1982).

This paper describes the design, construction, and performance of a commerical passive solar retrofit that has been added to the Empire Point Energy Education Center at the Tennessee Valley Authority's (TVA) Land Between The Lakes (LBL) facility in Golden Pond, Kentucky. The existing building had a screened porch and six small double-hung windows on the south side making it an ideal candidate for the incorporation of passive solar strategies. The passive retrofit involved the conversion of the porch area to a sunspace or solar greenhouse and enlarging the windows to increase the direct solar gain of the building. The design solution emphasized aesthetics as well as performance techniques that use of materials and techniques that could easily be duplicated by individuals in similar commerical or residential conversions. The passive retrofit has greatly improved the appearance of the facility, increased usable space, and is saving energy. The project, funded under the Department of Energy's (DOE) Solar Federal Buildings Program, was designed by TVA and constructed by a local contractor.

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 5853

5882 **(EUR—8353-EN) Absorber surfaces and durability of solar heat collectors.** Bogaerts, W.; Haute, A. van; Pacolet, M. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1983. 70p. Commission of the European Communities, Luxembourg.

Commercially or potentially available selective and non-selective absorber surfaces for solar heat collectors are reviewed and the state-of-the-art of solar collector corrosion processes is outlined. The review of available published literature has indicated that lack of quantitative information exists at the present time relative to corrosion of collector surfaces. Available information (mostly qualitative) on durability aspects and corrosion of solar receiver surfaces is described to indicate potential corrosion problem areas and corrosion prevention possibilities. An outline of appropriate durability tests is presented.

5883 **(PB—83-254425) Calibration of instruments used in determining the thermal performance of solar collectors.** Andersson, H.E.B.; Streed, E.; Gillett, W.B. (Statens Provningsanstalt, Boraes (Sweden)). 1983. 14p. (SP-RAPP—1983-20). NTIS, PC E03/MF E01.

The report contains a compilation of calibration procedures to be used when calibrating radiation, temperature and fluid flow measuring instruments in solar collector testing. The writing was part of the work within IEA (International Energy Agency) program to develop and test solar heating and cooling systems; task III, Performance testing of solar collectors; subtask A, Standard test procedures to determine thermal performance.

5884 **(TENRAC/EDF—117) Thermal and electric energy and desalination with a salt gradient solar pond.** Reid, R.L. (Texas Univ., El Paso (USA). Dept. of Mechanical and Industrial Engineering). 31 Aug 1983. 50p. NTIS, PC A03/MF A01. Order Number DE84900416.

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A 3355 m^2 (0.83 acre) storage pond in El Paso, Texas is being converted to a salt gradient solar pond. The existing pond (constructed in 1976) has a Hypalon rubber lining and is approximately 3 m (10 ft.) deep. Approximately 1.8 x 10^6 kg (2070 tons) of salt has been obtained for only the cost of shipping from the source located 322 km (200 miles) from the El Paso pond. The lower storage zone in the pond will be 1.5 m (5 ft.) in thickness while the the nonconvecting gradient zone will be 1.2 m (4 ft.) thick and the upper convecting zone will be 0.3 m (1.0 ft.) thick. During the period of this report, the following tasks have been completed: transport and management of the salt, pond clean-up and liner inspection, preparation of a work plan and schedule, selection of the methods for disolution and separation of insolubles based on laboratory tests, development of an economic computer program, and parametric studies with the SOLPOND simulation program.

5885 **Development of a point-electrode conductivity salinometer with high spatial resolution for use in very saline solutions.** Grimmer, D.P.; Jones, G.F.; Tafoya, J.; Fitzgerald, T.J. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Review of Scientific Instruments;* **54**: No. 12, 1744-1748(Dec 1983).

A conductivity probe and circuit were developed to measure salinities in sodium chloride salt-gradient solar ponds. A point-electrode salinometer design was chosen to give spatial resolution approximately 0.039 in. (1 mm). Such high spatial resolution was necessary to study the behavior of thermohaline columns in the vicinity of convective/conductive zone interfaces. The point-electrode conductivity instrument was designed for use in up to 25% (by weight) salinities with immersion times on the order of magnitude of 0.1 year or longer. Drift in the instrument, caused principally by changes in the surface condition of the platinum probe tip and reflected by changes in the probe cell constant, required periodic in situ calibration against the measured specific gravity of withdrawn fluid samples.

15 GEOTHERMAL ENERGY

5886 **(DOE/ER/30041—T1) Supplement to the technical assessment of geoscience-related research for geothermal energy technology. Final report.** (Engineering and Economics Research, Inc., Vienna, VA (USA)). Sep 1983. Contract AC01-82ER30041. 381p. NTIS, PC A17/MF A01. Order Number DE84002373.

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Detailed information (e.g., project title, sponsoring organization, research area, objective status, etc.) is presented for 338 geoscience/geothermal related projects. A summary of the projects conducted by sponsoring organization is presented and an easy reference to obtain detailed information on the number and type of efforts being sponsored is presented. The projects are summarized by research area (e.g., volcanology, fluid inclusions, etc.) and an additional project cross-reference mechanism is also provided. Subsequent to the collection of the project information, a geosciences classification system was developed to categorize each project by research area (e.g., isotope geochemistry, heat flow studies) and by type of research conducted (e.g., theoretical research, modeling/simulation). A series of matrices is included that summarize, on a project-by-project basis, the research area addressed and the type of R and D conducted. In addition, a summary of the total number of projects by research area and R and D type is given.

1501 Resource Status And Assessment

REFER ALSO TO CITATION(S) 5740, 5763

5887 **(USGS-OFR—83-250) Selected data for low-temperature (less than 90°C) geothermal systems in the United States: reference data for US Geological Survey Circular 892.** Reed, M.J.; Mariner, R.H.; Brook, C.A.; Sorey, M.L. (Geological Survey, Menlo Park, CA (USA)). [nd]. 132p. USGS-Open File Service, Box 25425, Denver Fed. Ctr., Denver, CO 80225.

Supporting data are presented for the 1982 low-temperature geothermal resource assessment of the United States. Data are presented for 2072 geothermal sites which are representative of 1168 low-temperature geothermal systems identified in 26 States. The low-temperature geothermal systems consist of 978 isolated hydrothermal-convection systems, 148 delineated-area hydrothermal-convection systems, and 42 delineated-area conduction-dominated systems. The basic data and estimates of reservoir conditions are presented for each geothermal system, and energy estimates are given for the accessible resource base, resource, and beneficial heat for each isolated system.

1502 Geology And Hydrology Of Geothermal Systems

REFER ALSO TO CITATION(S) 5900

5888 **(DOE/ET/27014—T5) Low-temperature geothermal resource and stratigraphy of portions of Yakima County, Washington.** Biggane, J. (Washington State Univ., Pullman (USA). Geological Engineering Section). 30 Jul 1982. Contract AC07-79ET27014. 146p. NTIS, PC A07/MF A01. Order Number DE84004870.

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The low-temperature geothermal resource of portions of Yakima County, south-central Washington, is defined by several least squares linear regression analyses of bottom-hole temperature and depth data. Intra-borehole flow prevents the use of borehole temperature gradients for geothermal resource assessment. Bottom-hole temperature and depth data were separated into fourteen well data groups based on geographic proximity, land slope azimuth, and position within the regional ground-water flow system. The regression analyses of these well data groups indicate that the projected land-surface temperature and geothermal gradient range from 10.6 to 14.0°C and from 24.9 to 52.2°C/km, respectively. The depth to the 20°C isotherm ranges from 142 to 346m. The average projected land-surface temperature and geothermal gradient are approximately 11.3°C and 43.0°C/km, respectively. The average depth to the 20°C isoterm is approximately 202m. The projected land-surface temperature appears to decrease and the depth to the 20°C isotherm appears to increase as the land-surface elevation of the well dat group increases. Stratigraphic correlation diagrams developed from borehole geophysical and lithologic logs are given for localities within the lower Yakima, Black Rock, Moxee, Ahtanum, Cowiche, and Naches valleys. These correlation diagrams are combined with their respective borehole temperatue logs and well data group predicted temperature curves to assess the validity of the regression analyses and to determine aquifer locations, temperatures, and directions of intra-borehole flow.

5889 **(USGS-OFR—82-200A) Geologic setting of massive sulfide deposits and hydrothermal vents along the southern Juan de Fuca Ridge.** Normark, W.R.; Morton, J.L.; Delaney, J.R. (Geological Survey, Menlo Park, CA (USA); Washington Univ., Seattle (USA)). 1982. 22p. USGS-Open File Service, Box 25425, Denver Fed. Ctr., Denver, CO 80225.

This report incorporates data from two cruises of the USGS vessel SP LEE: (1) L12-80-WF from 29 October to 13 November 1980, and (2) L11-81-WF from 4 to 15 September 1981. The 1980 cruise occurred long after the optimum weather window for this region. The natural results was that no photographic or sample stations could be attempted during nearly continuous gale- and storm-force winds, which twice forced the vessel to depart the work area

for safety. A detailed bathymetric survey of a 35-km segment of the ridge axial zone was completed nonetheless, and the bathymetric map compiled from this survey was used as the base for our second cruise in 1981. The second visit to the area was blessed with fair weather, and most of the cruise effort was devoted to photography and sampling, including dredging and hydrocasts in the axial valley segment, which is the central part of the area surveyed in 1980.

5890 **(USGS-OFR—82-1068) Statistical study of seismicity associated with geothermal reservoirs in California.** Hadley, D.M.; Cavit, D.S. (Sierra Geophysics, Inc., Arcadia, CA (USA)). 1982. 89p. USGS Open File Service, Box 25425-Denver Fed Ctr, Denver, CO 80225.

Statistical methods are outlined to separate spatially, temporally, and magnitude-dependent portions of both the random and non-random components of the seismicity. The methodology employed compares the seismicity distributions with a generalized Poisson distribution. Temporally related events are identified by the distribution of the interoccurrence times. The regions studied to date include the Imperial Valley, Coso, The Geysers, Lassen, and the San Jacinto fault. The spatial characteristics of the random and clustered components of the seismicity are diffuse and appear unsuitable for defining the areal extent of the reservoir. However, from the temporal characteristics of the seismicity associated with these regions a general discriminant was constructed that combines several physical parameters for identifying the presence of a geothermal system.

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 5739, 5888

5891 **(USGS-OFR—79-851) Drilling data from exploration well 2-2A, NW1/4, sec 15, T. 5 N., R. 31 E., Idaho National Engineering Laboratory, Butte County, Idaho.** Doherty, D.J. (Geological Survey, Idaho Falls, ID (USA)). Sep 1979. 20p. NTIS PC A02/MF A01. Order Number DE84004009.

The lithology of well 2-2A is described and the temperature distribution and the geophysical logs are shown. (MHR)

5892 **(USGS-OFR—79-1136) Near-surface heat flow in Saline Valley, California.** Mase, C.W.; Galanis, S.P. Jr.; Munroe, R.J. (Geological Survey, Menlo Park, CA (USA)). 1979. 56p. NTIS, PC A04/MF A01. Order Number DE84900438.

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With the exception of values from one borehole drilled at Palm Spring and three boreholes drilled around Saline Valley dry lake, eight new heatflow values in Saline Valley, California, are within or somewhat below the range one would expect for this region of the Basin and Range heat-flow province. The lack of recent volcanism in the area and the apparently normal Basin and Range heat flow suggest that geothermal systems within the valley are stable stationary phases supported by high regional heat flow and forced convection.

5893 **(USGS-OFR—81-994) Total field aeromagnetic map of the Long Valley Geothermal Resource Area, California by the US Geological Survey.** (Geological Survey, Denver, CO (USA)). 1981. 24p. USGS Open File Service, Box 25425-Denver Fed Center, Denver, CO 80225.

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5894 **(USGS-OFR—81-995) Total field aeromagnetic anomaly map, Wabuska known Geothermal Resource Area, Nevada by the US Geological Survey.** (Geological Survey, Denver, CO (USA)). 1981. 12p. USGS-Open File Service, Box 25425-Denver Fed Center, Denver, CO 80225.

5895 **(USGS-OFR—81-996) Total field aeromagnetic map of the Steamboat Hills known Geothermal Resource Area, Nevada.** (Geological Survey, Las Vegas, NV (USA)). 1981. 4p. USGS Open File Service, Box 25425-Denver Fed Ctr, Denver, CO 80225.

5896 **(USGS-OFR—81-997) Total field aeromagnetic map, Surprise Valley known Geothermal Resource Area, California by the US Geological Survey.** (Geological Survey, Denver, CO (USA)). 1981. 20p. USGS-Open File Service, Box 25425-Denver Fed Center, Denver, CO 80225.

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5897 **(USGS-OFR—81-998) Total field aeromagnetic map of the Raft River known Geothermal Resource Area, Idaho by the US Geological Survey.** (Geological Survey, Denver, CO (USA)). 1981. 9p. USGS-Open File Service, Box 25425-Denver Fed Center, Denver, CO 80225.

5898 **(USGS-OFR—82-127) Self-potential surveys related to probable geothermal anomalies, Hualalai Volcano, Hawaii.** Jackson, D.B.; Sako, M.K. (Geological Survey, Hawaii National Park, HI (USA). Hawaiian Volcano Observatory). 1979. 19p. USGS-Open File Service, Box 25425, Denver Fed. Ctr., Denver, CO 80225.

Comparison of topographic gradients with self-potential fields on Hualalai suggests that for the southeastern and summit areas a topographic correction of approximately 1.6 mv/m is probably valid and should be made to all data. Northwest of the summit, elevation and SP correlations suggest that the streaming potential coupling coefficient is larger than farther east, and the topographic adjustments should probably be larger than the 1.6 mv/m that was used.

5899 **(USGS-OFR—82-846) Mineral and geothermal resource potential of Wild Cattle Mountain and Heart Lake roadless areas Plumas, Shasta, and Tehama Counties, California.** Muffler, L.J.P.; Clynne, M.A.; Cook, A.L. (Geological Survey, Denver, CO (USA)). 1982. 32p. USGS-Open File Service, Box 25425, Denver Fed. Ctr., Denver, CO 80225.

The results of geological, geochemical, and geophysical surveys in Wild Cattle Mountain and Heart Lake Roadless Areas indicate no potential for metallic or non-metallic mineral resources in the areas and no potential for coal or petroleum energy resources. However, Wild Cattle Mountain Roadless Area and part of Heart Lake Roadless Area lie in Lassen Known Geothermal Resources Area, and much of the rest of Heart Lake Roadless Area is subject to non-competitive geothermal lease applications. Both areas are adjacent to Lassen Volcanic National Park, which contains extensive areas of fumaroles, hot springs, and hydrothermally altered rock; voluminous silicic volcanism occurred here during late Pleistocene and Holocene time. Geochemical data and geological interpretation indicate that the thermal manifestations in the Park and at Morgan and Growler Hot Springs (immediately west of Wild Cattle Mountain Roadless Area) are part of the same large geothermal system. Consequently, substantial geothermal resources are likely to be discovered in Wild Cattle Mountain Roadless Area and cannot be ruled out for Heart Lake Roadless Area.

5900 **(USGS-OFR—82-926) Lassen geothermal system.** Muffler, L.J.P.; Nehring, N.L.; Truesdell, A.H.; Janik, C.J.; Clynne, M.A.; Thompson, J.M. (Geological Survey, Menlo Park, CA (USA)). 1982. 9p. USGS-Open File Service, Box 25425, Denver Fed. Center, Denver, CO 80225.

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The Lassen geothermal system consists of a central vapor-dominated reservoir underlain by hot water that discharges peripherally at lower elevations. The major thermal upflow at Bumpass Hell (elevation 2500 m) displays numerour superheated fumaroles, one of which in 1976 was 159°C. Gas geothermometers from the fumarole areas and water geothermometers from boiling Cl-bearing waters at Morgan Hot Springs (elevation 1530 m; 8 km south of Bumpass Hell) and from 176°C waters in a well 12 km southeast of Bumpass Hell both indicate 230 to 240°C for the deep thermal water. With increasing distance from Bumpass Hell, gases are pro-

gressively depleted in H_2S relative to CO_2 and N_2, owing to oxidation of H_2S to pyrite, sulfur, and sulfates and to dilution with atmospheric N_2. H_2O/gas ratios and degree of superheat of fumaroles can be explained by mixing of steam of maximum enthalpy (2804 J g^{-1}) with near-surface water and with the condensate layer overlying the vapor-dominated reservoir.

5901 **(USGS-OFR—82-932) Aeromagnetic measurements in the Cascade Range and Modoc Plateau of northern California. Report on work done from June 1, 1980-November 30, 1980.** Couch, R.; Gemperle, M. (Oregon State Univ., Corvallis (USA)). 1982. 26p. USGS-Open File Service, Box 25425, Denver Fed. Ctr., Denver, CO 80225.

Aeromagnetic measurements made along flightlines oriented east-west and spaced at 1.6-km intervals and along lines oriented north-south and spaced at 8-km intervals, over approximately 30,000 square km of northern California, exhibit crossing errors of less than 5 nanoTeslas. The measurements show short-wavelength magnetic anomalies associated with near-surface volcanics over and east of Lassen Peak and over and north of Mt. Shasta and the Medicine Lake Highlands, longer wavelength anomalies over the Modoc Plateau, and very long wavelength anomalies over the northernmost part of the Great Valley and the easternmost metamorphic rocks of the Klamath Mountains. Anomaly patterns exhibit northwest-southeast trends over the Modoc Plateau and a marked change in character at the juncture of the plateau and the Klamath Mountain and Great Valley complexes.

5902 **(USGS-OFR—82-933) Aeromagnetic measurements in the Cascade Range and Modoc Plateau of northern California. Report on work done from December 1, 1980-May 31, 1981.** Couch, R.; Gemperle, M. (Oregon State Univ., Corvallis (USA)). 1982. 34p. NTIS, PC A03/MF A01. Order Number DE84900455.

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Spectral analysis of aeromagnetic data collected over north-central California during the summer of 1980 aided in determining magnetic-source bottom depths beneath the survey area. Five regions of shallow magnetic source bottom depths were detected: (1) Secret Spring Mountain and National Lava Beds Monument area; (2) the Mount Shasta area; (3) the Eddys Mountain area; (4) the Big Valley Mountains area; and (5) an area northeast of Lassen Peak. Except for the Eddys Mountain area, all regions exhibiting shallow depths are suggested to be due to elevated Curie-point isotherms. Deeper magnetic source bottom depths were mapped throughout the remainder of the study area, with depths greater than 9 km BSL indicated beneath Lassen Peak and greater than 11 km BSL indicated beneath the Western Cascades, Eastern Klamath Mountains, and Great Valley.

5903 **(USGS-OFR—82-994) Shallow subsurface temperatures and some estimates of heat flow from the Colorado Plateau of northeastern Arizona.** Sass, J.H.; Stone, C.; Bills, D.J. (Geological Survey, Denver, CO (USA)). 1982. 112p. USGS-Open File Service, Box 25425, Denver Fed. Ctr., Denver, CO 80225.

Temperature data to depths of a few hundred meters were obtained from 29 wells in northeastern Arizona; 12 in the region surrounding the San Francisco Volcanic Field, 8 in the Black Mesa area, and 9 in the south-central Colorado Plateau which includes the White Mountains. Although there was evidence for local hydrologic disturbances in many temperature profiles, most wells provided an estimate of the conductive thermal gradient at the site. A few thermal conductivities were measured and were combined with published regional averages for the north-central part of the Colorado Plateau to produce crude estimates of regional heat flux. None of the wells was accessible below the regional aquifers. To these depths, heat flow in the area of the San Francisco Volcanic Field appears to be controlled primarily by regional lateral water movement having a significant downward vertical component of velocity. The mean heat flow of 27 +- 5 mWm^{-2} is only a third to a quarter of what we would expect in this tectonic setting. The heat that is being carried laterally and downward probably is being discharged at low enthalpy and low elevation in springs and streams of the Colorado Plateau and Mogollon Rim. In the vicinity of Black Mesa, heat-flow averages about 60 mWm^{-2}, characteristics of the coal interior of the Colorado Plateau. North of the White Mountain Volcanic Field, the average heat flow is about 95 mWm^{-2}.

1504 Legal And Institutional Aspects

5904 **(P—500-83-009) Geothermal grant program for local governments: revised grant application manual.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). Mar 1983. 33p. California Energy Comm., 1516 9th St, MS-43, Sacramento, CA 95814.

This revised grant application manual describes the kinds of activities eligible for geothermal grants, who may apply, and how to apply. It also describes the criteria and procedures the California Energy Commission will use in selecting proposals for grant awards.

1508 Geothermal Power Plants

5905 **(N—8327375) Heber Binary Project. Binary Cycle Geothermal Demonstration Power Plant (RP1900-1).** Lacy, R.G.; Nelson, T.T. (San Diego Gas and Electric Co., CA (USA)). Dec 1982. 7p. (CONF-820691—). NTIS, PC A13/MF A01.

From 6. annual geothermal conference; Snowbird, UT, USA (29 Jun 1982).

In Proc. of the 6th Ann. Geothermal Conf. and Workshop, 7 p (SEE N83-27372 16-44).

The Heber Binary Project (1) demonstrates the potential of moderate temperature (below 410 F) geothermal energy to produce economic electric power with binary cycle conversion technology (2) allows the scaling up and evaluation of the performance of binary cycle technology in geothermal service (3) establishes schedule, cost and equipment performance, reservoir performance, and the environmental acceptability of such plants and (4) resolves uncertainties associated with the reservoir performance, plant operation, and economics.

1509 Geothermal Engineering

5906 **(LA—9780-HDR) Hot dry rock geothermal energy development program. Annual report, fiscal year 1982.** Smith, M.C.; Nunz, G.J.; Ponder, G.M. (eds.). (Los Alamos National Lab., NM (USA)). Sep 1983. Contract W-7405-ENG-36. 131p. NTIS, PC A07/MF A01. Order Number DE84003699.

Emphasis in the Hot Dry Rock Program was on development of methods to produce the hydraulic fractures required to connect the deep, inclined wells of the Phase II system at Fenton Hill. Environmental surveillance, instrument development, laboratory and modeling studies, and other supporting activities were continued. After two unsuccessful attempts to fracture hydraulically through inflatable packers, formation breakdown was produced in an uncased section near the bottom of well EE-2 by pumping water through a cemented-in steel liner. Breakdon occurred at a wellhead pressure of 33.1 MPa and a total of 8539 m^3 of water was injected. Mapping of source locations of microseismic events indicated opening of an extensive set of planar features dipping about 40°W, striking about N20°W, and apparently passing beneath the bottom of well EE-3. An attempt was then made to fracture at a higher level where the relative positions of the two wells increased the probability that an inclined fracture would connect them. Repeated failures of drill pipe, tubing, couplings, and packers terminated most pumping experiments prematurely. Important advances were made in thermal protection of downhole instruments, real-time mapping source locations of microseismic signals, modeling of heat and mass transport, and the mechanics of hydraulic fracturing.

1520 Geothermal Data And Theory

REFER ALSO TO CITATION(S) 5783

5907 **(USGS-OFR—82-98) Chemical and isotopic composition of water from thermal and mineral springs of Washington.** Mariner, R.H.; Presser, T.S.; Evans, W.C. (Geological Survey, Menlo Park, CA (USA)). Feb 1982. 20p. USGS Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225.

Waters from the thermal springs of Washington range in chemical composition from dilute Na-HCO_3 to moderately saline CO_2-charged Na-HCO_3-Cl type waters. St. Martin's Hot Spring which discharges a slightly saline Na-Cl water, is the notable exception. The dilute Na-HCO_3 waters are generally associated with granitic intrusions; the warm to hot CO_2-charged waters issue on or near the large stratovolcanoes. The dilute waters have oxygen-isotopic compositions that indicate relatively little water-rock exchange. The CO_2-charged waters are usually more enriched in oxygen-18 due to more extensive water-rock reaction. The carbon-13 in the CO_2-charged thermal waters is more depleted (-10 to -12 %) than in the cold CO_2-charged soda springs (-2 to -8%) which are also scattered throughout the Cascades. The hot and cold CO_2-charged waters are supersaturated with respect to $CaCO_3$, but only the hot springs are actively depositing $CaCO_3$. Baker, Gamma, Sulphur, and Ohanapecosh hot springs seem to be associated with thermal aquifers of more than 100°C. As these springs occur as individual springs or in small clusters, the respective aquifers are probably of restricted size.

17 WIND ENERGY

5908 **(ERATL—83/30) European national wind power programmes.** Buss, B. (ERA Technology Ltd., Leatherhead (UK)). Dec 1979. 32p. (ERA—79-116). NTIS $45.00.

The paper reviews the national wind power programmes in Europe and provides tabulated data on the development of large machines within each programme. Countries covered by the review are Sweden, West Germany, the Netherlands, Denmark, the UK and Norway and brief comments are given on activity in Spain, Greece and Romania. The report includes a bibliography with 15 references.

1706 Wind Energy Engineering

5909 **(SAND—82-1016) Frequency and mode shape calculations for vertical axis wind turbines using reduction techniques and complex eigensolvers.** Koteras, J.R. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1983. Contract AC04-76DP00789. 27p. NTIS, PC A03/MF A01. Order Number DE84003316.

This study was done to assess the reliability of reduction techniques and complex eigensolvers when used to compute frequencies and mode shapes for finite element models of vertical axis wind turbines. Reduction schemes are a means to produce a lower order system of equations which accurately describe the dynamic characteristics of complex structures and hence reduce the cost of eigensolutions. Two reduction schemes - Gugan reduction and generalized dynamic reduction - and two Hessenberg method - were examined. Although there are four possible combinations of reduction method and eigensolver, only two were extensively examined. These combinations were Guyan reduction plus the inverse power method and generalized dynamic reduction plus the upper Hessenberg method. Both combinations worked reliably for the calculation of frequencies and mode shapes of three different wind turbine models when certain basic guidelines were followed. The size of the reduced problem which can be obtained from a particular reduction scheme determines which computational approach is more efficient.

20 ELECTRIC POWER ENGINEERING

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 5728, 5731

5910 **(INIS-mf—8222) Simulation of the power plant unit for the purpose of accident analysis and optimum countermeasures. Pt. 2.** Dolezal, R. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Verfahrenstechnik und Dampfkesselwesen). Oct 1982. 41p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83703966.

Description of a computer program to enable a process computer connected 'on-line' with the power block 1) to identify the nature and probable cause of an occuring failure, and 2) to influence the plant by means of a pre-planned failure removal strategy in such manner that not only a considerable secondary failure is avoided but that the plant, as far as possible, is kept operating. (orig.).

5911 **Power-plant performance trends and the potential for productivity improvement.** Gielecki, M. (Energy Information Administration, US DOE, Washington, DC); Markley, E. *Public Utilities Fortnightly;* **112**: No. 11, 37-42(24 Nov 1983).

In an analysis of electric-power-plant performance trend, this article quantifies the deterioration in that performance over time, observes the implications of deteriorating performance trends in terms of generating capability potentially unavailable to meet demand and some of the costs thereof, and discusses strategies to mitigate the declining-performance trends. One conclusion is that declining generating-unit performance causes reserve capacities to be generally overstated. 12 references, 4 figures, 5 tables.

2003 Power Transmission And Distribution

REFER ALSO TO CITATION(S) 6718, 6719

5912 **Induced voltage in a shared corridor.** Barry, R.O.; Dunlap, J.H. *EPRI (Electric Power Research Institute) Journal;* **8**: No. 8, 20-22(Oct 1983).

The induction of voltages on pipelines and railroad signal wires can be a problem when high-voltage transmission lines share the right of way. A handbook and two computer programs provide the analytic tools for utilities to avoid the problem.

21 NUCLEAR POWER PLANTS

REFER ALSO TO CITATION(S) 6003

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 5812, 5920, 5953, 5956, 5957, 5960, 5963, 5969, 5974

5913 **(CONF-831047—113) Nonlinear dynamics of boiling water reactors.** March-Leuba, J.; Cacuci, D.G.; Perez, R.B. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA). Dept. of Nuclear Engineering). 1983. Contract W-7405-ENG-26. 7p. NTIS, PC A02/MF A01. Order Number DE84003271.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

Recent stability tests in Boiling Water Reactors (BWRs) have indicated that these reactors can exhibit the special nonlinear behavior of following a closed trajectory called limit cycle. The existence of a limit cycle corresponds to an oscillation of fixed amplitude and period. During these tests, such oscillations had their amplitudes limited to about +- 15% of the operating power. Since limit cycles are fairly insensitive to parameter variations, it is possi-

ble to operate a BWR under conditions that sustain a limit cycle (of fixed amplitude and period) over a finite range of reactor parameters.

5914 **(DOE/ET/34006—12) Extended burnup demonstration reactor fuel program. Annual progress report, April 1982-March 1983.** Exarhos, C.A. (Consumers Power Co., Jackson, MI (USA); Exxon Nuclear Co., Inc., Richland, WA (USA); GPU Nuclear Corp., Parsippany, NJ (USA)). 31 Oct 1983. Contract AC02-79ET34006. 35p. (XN-NF—83-59). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84003860.

The 1983 progress report covers work performed under the EBD program between April 1982 and March 1983. Three major milestones were met during this period: the four Oyster Creek assemblies were discharged at an average exposure of 34,500 MWD/MTU; fission gas measurements were performed at poolside and in hot cell on 31 Big Rock Point fuel rods; the hot cell examination of four high burnup Big Rock Point rods, including two urania and two gadolinia, was begun. The fission gas measurements showed a maximum gas release of 5.4% in a high enrichment urania rod, a level well below that observed in other BWRs, most likely because of the low center-line temperatures experienced by the Big Rock Point fuel. Preliminary results from the hot cell examination indicate that the fuel remains in excellent condition at rod average exposures up to 39,000 MWD/MTU.

5915 **(DOE/NE—0030/9) US central station nuclear electric generating units: significant milestones. Status as of July 1, 1983.** (USDOE Assistant Secretary for Nuclear Energy, Washington, DC. Office of Converter Reactor Deployment). Oct 1983. 37p. NTIS, PC A03/MF A01. Order Number DE84003859.

Information is presented concerning nuclear power plant specifications; state listing of nuclear power plants; regional listing of nuclear power plants; utility listing of nuclear power plants; and tabulations of status, schedules, and orders.

5916 **(EGG-M—19783) Performance of artificially defected LWR fuel rods in an unlimited air dry storage atmosphere.** Einziger, R.E.; Knecht, R.L.; Cantley, D.A.; Cook, J.A. (Westinghouse Hanford Co., Richland, WA (USA); EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1983. Contract AC07-76ID01570. 18p. (CONF-8310143—38). NTIS, PC A02/MF A01. Order Number DE84002206.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

Thus far the tests are inconclusive as to whether breached LWR fuel can be stored at 230°C for long periods of time in air without fuel oxidation and dispersion. There is every indication, as expected, that there is no oxidation problem in an inert atmosphere. Only one of four defects exposed to unlimited air gave any indication of fuel oxidation. It has been suggested that this might be an incubation effect and continued operation would result in oxidation occurring at all four defects. As yet the destructive examination of the BWR rod has not been completed, so it is not possible to determine if cladding splitting was due to an anomoly in this test rod or something that can be expected in LWR rods in general. Thus far there is no indication of respirable particle dispersal even if fuel oxidation does occur.

5917 **(NUREG/CR—3154) In-plant reliability data base for nuclear plant components: interim report - the valve component.** Borkowski, R.J.; Kahl, W.K.; Hebble, T.L.; Fragola, J.R.; Johnson, J.W. (Oak Ridge National Lab., TN (USA)). Dec 1983. Contract W-7405-ENG-26. 59p. (ORNL/TM—8647). NTIS, PC A04/MF A01 - GPO. Order Number DE84003583.

This report on valves in the IPRDS documents the type of reliability information that could be generated using the current IPRDS methodology on an expanded data base. Preliminary results and various methods for their documentation are presented as suggested methods for reporting results in a data manual. Comparison of preliminary results within a plant, between plants, and among other data sources are made to exemplify some of the alternate uses of the IPRDS information that would be possible with an expanded data base.

5918 **(NUREG/CR—3334-Vol.2) Heavy-section steel technology program quarterly progress report for April-June 1983. Volume 2.** Pugh, C.E. (Oak Ridge National Lab., TN (USA)). Dec 1983. Contract W-7405-ENG-26. 135p. (ORNL/TM—8787-Vol.2). NTIS, PC A07/MF A01 - GPO. Order Number DE84003981.

Analyses were performed to determine material parameters and pressure-temperature transients compatible with potential pressurized-thermal-shock experiments. Subcontractors continued studies on crack arrest, crack reinitiation, fracture transition, and environmentally assisted crack growth. Charpy tests were performed for both irradiated and unirradiated specimens (state-of-the art welds) in the Fourth Irradiation Series. Irradiation of the first two capsules containing Charpy and tensile specimens of one-wire stainless steel cladding was begun. Thermal-shock experiment TSE-7 was conducted, and properties for the TSE-7 test material were determined. Preparations for the first pressurized-thermal-shock experiment (PTSE-1) continued. Construction of the test facility was completed; analyses of potential test histograms were performed; and fabrication of the two vessels for use in the shakedown test and the PTSE-1 was completed.

5919 **(UCID—19723) Technical evaluation report on the electrical, instrumentation, and control design aspects of the proposed license amendment revision 1 for single-loop operation of the Duane Arnold Energy Center, Unit 1 (Docket No. 50-331).** Donich, T.R. (Lawrence Livermore National Lab., CA (USA)). 14 Dec 1983. Contract W-7405-ENG-48. 7p. NTIS, PC A02/MF A01. Order Number DE84004860.

This report documents the technical evaluation of the proposed changes to the plant reactor protection system by the licensee of Duane Arnold Energy Center, Unit 1 to account for single-loop plant operation. This evluation is restricted to only the electrical, instrumentation, and control design aspects of proposed changes to the plant technical specifications for single-loop operation beyond 24 hours. The conclusion of the evaluation is that the Duane Arnold license amendment for single-loop operation has met the review criteria provided anomalous control room indications are corrected or warning-tagged for the duration of single-loop operation.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 5915, 5916, 5917, 5918, 5929, 5930, 5931, 5932, 5953, 5954, 5963, 5965, 5967, 5969, 5971, 5972, 5973

5920 **(CONF-831047—119) Ultrasonic level and temperature sensor for power reactor applications.** Dress, W.B.: Miller, G.N. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 9p. NTIS, PC A02/MF A01. Order Number DE84003381.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

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An ultrasonic waveguide employing torsional and extensional acoustic waves has been developed for use as a level and temperature sensor in pressurized and boiling water nuclear power reactors. Features of the device include continuous measurement of level, density, and temperature producing a real-time profile of these parameters along a chosen path through the reactor vessel.

5921 **(EGG-M—06383) Micro-Raman analysis of Three Mile Island samples.** Doyle, T.E.; Alvarez, J.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 7p. (CONF-830815—10). NTIS, PC A02/MF A01. Order Number DE84001003.

From 18. annual Microbeam Analysis Society conference; Phoenix, AZ, USA (8 Aug 1983).

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Using a Raman microprobe, samples were analyzed from Three Mile Island Unit 2 (TMI-2). The purpose of examining TMI-2 samples is threefold: to determine the various chemical species resulting from a nuclear release accident; to better explain the presence, transport, and consequences of release to the environment of

specific chemical species; and to clarify and define the accident scenario. One result from the work will be discussed in this paper: the positive identification of zirconium oxide, and particles that produce spectra characteristic of ZrO_2, in the TMI-2 purification system. Spectra of the latter particles reveal differences from the ZrO_2 in crystalline structure that may provide information about processes that occurred in the TMI-2 core.

5922 **(SAND—83-1806C) Structural analyses of PWR containments subjected to internal pressurization.** Jung, J. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 8p. (CONF-8310143—6-Summ.). NTIS, PC A02/MF A01. Order Number DE84001752.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

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Structural analyses of the Watts Bar, Maine Yankee and Bellefonte containment structures were performed as part of the Severe Accident Sequence Analysis (SASA) program. The objective of these analyses was to obtain realistic estimates of the ultimate pressure capabilities of these containments. The three containments considered are representative of the different containment types. The Watts Bar containment is a hybrid steel type, the Maine Yankee containment is reinforced concrete and the Bellafonte containment is prestressed concrete. It was concluded that a realistic ultimate pressure range for the Watts Bar containment is between 120 and 140 psig. The ultimate pressure capability of the Maine Yankee containment is between 96 and 118 psig. The pressure capbility of the Bellefonte containment is 130 to 139 psig.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 5915, 6227

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

REFER ALSO TO CITATION(S) 5964

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 5772, 5960, 6150, 6880

5923 **(CONF-830930—1) Approaches to measurement of thermal-hydraulic parameters in liquid-metal-cooled fast breeder reactors.** Sackett, J.I. (Argonne National Lab., Idaho Falls, ID (USA)). 1983. Contract W-31-109-ENG-38. 33p. NTIS, PC A03/MF A01. Order Number DE84004022.

From 15. ICHMT symposium on heat and mass transfer measurement techniques; Dubrovnik, Yugoslavia (5 Sep 1983).

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This lecture considers instrumentation for liquid-metal-cooled fast breeder reactors (LMFBR's). Included is instrumentation to measure sodium flow, pressure, temperature, acoustic noise, and sodium purity. It is divided into three major parts: (1) measurement requirements for sodium cooled reactor systems, (2) in-core and out-of-core measurements in liquid metal systems, and (3) performance measurements of water steam generators.

5924 **(DOE/ET/37240—106) Coolant mixing in LMFBR rod bundles and outlet-plenum mixing transients. Progress report, December 1, 1982-February 28, 1983.** Todreas, N.E. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). Aug 1983. Contract AC02-76ET37240. 56p. NTIS, PC A04/MF A01. Order Number DE84001261.

Progress is reported on a mixing experiment for a 37-pin bundle and models for mixed convection. Measurements were made in the 37-pin bundle for flow splits, friction factors, and mixing parameters.

5925 **(DOE/ET/37240—107) Coolant mixing in LMFBR rod bundles and outlet-plenum mixing transients. Progress report, March 1, 1983-May 31, 1983.** Todreas, N.E. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). Aug 1983. Contract AC02-76ET37240. 102p. NTIS, PC A06/MF A01. Order Number DE84001262.

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Progress is reported on: subchannel friction factor model for wire-wrapped rod bundles and models for mixed convection. Data are presented in tabular form.

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

REFER ALSO TO CITATION(S) 5966

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 5791, 5948

5926 **(UNI—2463) Evaluation of Nuclear Facility Decommissioning Projects program: a reference test reactor. Project summary report.** Boing, L.E.; Miller, R.L. (eds.). (UNC Nuclear Industries, Inc., Richland, WA (USA)). Oct 1983. Contract AC06-76RL01857. 149p. NTIS MF A01. Order Number DE84002338.

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This document presents, in summary form, generic conceptual information relevant to the decommissioning of a reference test reactor (RTR). All of the data presented were extracted from NUREG/CR-1756 and arranged in a form that will provide a basis for future comparison studies for the Evaluation of Nuclear Facility Decommissioning Projects (ENFDP) program. During the data extraction process no attempt was made to challenge any of the assumptions used in the original studies nor was any attempt made to update assumed methods or processes to state-of-the-art decommissioning techniques. In a few instances obvious errors were corrected after consultation with the study author.

5927 **(NE-M—5-23T(4/81)(Rev.)) Steel plates for nuclear and other special applications (ASME SA-647 with additional requirements).** (Department of Energy, Washington, DC (USA). Office of Nuclear Energy Programs). Apr 1981. 11p. Nuclear Standards Management Center, Oak Ridge, TN.

This standard covers carbon steel, and medium and high alloy steel plates, sheets, and strips for nuclear and associated applications.

2108 Economics

5928 **(CONF-8310143—55) Nuclear power plant personnel entry level qualifications and training.** Jorgensen, C.C.; Haas, P.M.; Selby, D.L.; Lowry, J.C. (Oak Ridge National Lab., TN (USA); Nuclear Regulatory Commission, Washington, DC (USA)). 1983. Contract W-7405-ENG-26. 12p. NTIS, PC A02/MF A01. Order Number DE84003294.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

This paper summarizes the early results and current status of a research program at ORNL which is intended to provide the methods and technical basis for NRC to initiate the use of the Systems Approach to Training (SAT) in the evaluation of training programs and entry level qualifications for NPP control room personnel. The program is an outgrowth of previous studies of simulator hardware and simulator training requirements under the Safety Related Operator Actions Program which recommended adaptation of a systems methodology to development and evaluation of NPP training programs.

5929 **(ECC/P—1) Sizewell B power station public inquiry: Electricity Consumers' Council policy.** Barnes, M. (Electricity Consumers' Council, London (UK)). Jun 1983. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84900207.

Information is presented concerning the work of the Electricity Consumers' Council and its role at the inquiry; the economic case for Sizewell B and the price of electricity; and fuel diversity and security of electricity supply.

5930 **(ECC/P—2) Sizewell B power station public inquiry: construction times and costs.** MacKerron, G. (Electricity Consumers' Council, London (UK)). Jun 1983. 52p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84900217.

The major element in the generation cost of electricity from any nuclear power station is the capital charge arising from the construction cost - for Sizewell the CEGB estimates that capital charges will make up more than 65% of generation cost. Therefore in assessing the cost implications of Sizewell (and subsequent PWRs) it is important to review the capital cost and also the amount of output the plant produces - the more electricity the plant produces, the lower the capital charge per unit of electricity. This proof reviews the determinants of capital cost and construction time. The purpose of this proof is therefore to evaluate the CEGB's treatment of the likely capital cost and construction time of Sizewell B, covering both central estimates and sensitivity values.

5931 **(ECC/P—6) Sizewell B power station public inquiry: fuel diversity and security of electricity supply.** MacKerron, G. (Electricity Consumers' Council, London (UK)). Jun 1983. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84900024.

The main purpose of this proof is to suggest the kinds of argument that the CEGB would need to make to show that Sizewell will not only contribute to better security, but will also be part of the best strategy for security. This would require the Board to show a range of alternative policies or strategies to ensure better security (analogous to its treatment of AGR, PWR and coal-fired plant in the economic benefit case), and also to demonstrate the superiority of an option which includes a PWR at Sizewell. In addition, this proof also raises some of the substantive issues relating to security policy. In general, this Proof is offered as an exploratory rather than as a definitive exercise: it attempts to raise the whole range of issues that need to be considered in an overall security policy, in the absence of such a wide-ranging consideration by the CEGB.

5932 **(ECC/P—8) Sizewell B power station public inquiry: overall technical assessment of the economic benefit case.** Jones, I.; Mackerron, G.; Thomas, S. (Electricity Consumers' Council, London (UK)). Jun 1983. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84900006.

The purpose of this Proof is first in Part II to consider the assumptions made by the CEGB concerning the specification of the plant-mix background. This was discussed in the ECC Statement of Case but has not been covered in other ECC Proofs. Part III then brings together these findings with those of the other ECC proofs as they bear on the economic benefit case for Sizewell. Finally, Part IV discusses general issues in the CEGB's investment appraisal methodology, in particular the adequacy of the CEGB's analysis of project risk and uncertainty in the light of the earlier findings. The ECC Policy Proof (ECC/P/1) explores some possible implications of the findings presented in this Proof.

22 NUCLEAR REACTOR TECHNOLOGY

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 6290, 6880

2202 Components And Accessories

5933 **(PNL-SA—11634) Acoustic emission for on-line reactor monitoring: results of intermediate vessel test monitoring and reactor hot functional testing.** Hutton, P.H.; Kurtz, R.J. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1983. Contract AC06-76RL01830. 20p. (CONF-8310143—61). NTIS, PC A02/MF A01. Order Number DE84003259.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The objective of the acoustic emission (AE)/flaw characterization program is to provide an experimental feasibility evaluation of using the AE method on a continuous basis (during operation and during hydrotest) to detect and analyze flaw growth in reactor pressure vessels and primary piping. This effort is based on earlier results showing that AE has potential for being a valuable addition to nondestructive evaluation (NDE) methods with the added unique capability for continuous monitoring, high sensitivity and remote flaw location. Results are reported for the ZB-1 vessel test and the Watts Bar-1 hot functional test.

2203 Fuel Elements

5934 **(CONF-8310143—59) Fracture behavior of zircaloy spent-fuel cladding.** Chung, H.M.; Yaggee, F.L.; Kassner, T.F. (Argonne National Lab., IL (USA)). Oct 1983. Contract W-31-109-ENG-38. 29p. NTIS, PC A03/MF A01. Order Number DE84003414.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The Zircaloy cladding of water reactor fuel rods is susceptible to local breach-type failure, commonly known as pellet-cladding interaction (PCI) failure, during operational and off-normal power transients after the fuel has achieved a sufficiently high burnup. An optimization of power ramp procedures or fuel rod fabrication to minimize the cladding failure would result in a significant decrease in radiation exposure of plant personnel due to background and airborne radioactivity as well as an extension of core life in terms of allowable off-gas radioactivity. As part of a program to provide a better understanding of the fuel rod faiure phenomenon and to facilitate the formulation of a better failure criterion, a mechanistic study of the deformation and fracture behavior of high-burnup spent-fuel cladding is in progress under simulated PCI conditions.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 5980

5935 **(CONF-830847—6) Estimation of small area populations using remote sensing and other approaches.** Honea, R.B.; Shumpert, B.L.; Edwards, R.G.; Margle, S.M.; Coleman, P.R.; Smyre, J.L.; Rush, R.M.; Durfee, R.C. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 31p. NTIS, PC A03/MF A01. Order Number DE84003404.

From Energy resource management '83; San Francisco, CA, USA (23 Aug 1983).

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This paper documents the results of an assessment of a variety of techniques for estimating residential population for a five-mile radial grid around a nuclear power plant. The study area surrounded the proposed Limerick Nuclear Power Plant located near Philadelphia, PA. Techniques evaluated ranged from the use of air photos to infer population from housing distributions to the use of

Landsat data to characterize probable residential population around the plant site. Although the techniques involving the use of Landsat data provided good results, a simple proportional area allocation method and the current procedure used by Oak Ridge National Laboratory for the Nuclear Regulatory Commission were among the best techniques. Further research using other sites and better resolution satellite data is recommended to investigate the possible refinement of population estimates using remote sensing media. 34 references, 10 figures, 2 tables.

5936 **(NUREG/CR—2830) Permissible radionuclide loading for organic ion exchange resins from nuclear power plants.** MacKenzie, D.R.; Lin, M.; Barletta, R.E. (Brookhaven National Lab., Upton, NY (USA)). Oct 1983. Contract AC02-76CH00016. 103p. (BNL-NUREG—51565). NTIS, PC A06/MF A01 - GPO $4.75. Order Number DE84002898.

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A questionnaire on the use of ion exchange resins in nuclear power plants was sent to all operating reactors in the US. Responses were received from 23 of the 48 utilities approached. Information was sought concerning the amounts of radionuclides held by the resins, and the effects of its radiation on the resins both during operation and after removal from service. Relevant information from the questionnaires is summarized and discussed. Available literature on the effects of ionizing radiation on organic ion exchange resins has been reviewed. On the basis of published data on damage to resins by radiation, the technical rationale is given to support NRC's draft branch technical position on a maximum permissible radionuclide loading. It is considered advisable to formulate the rule in terms of a delivered dose rather than a curie loading. A maximum permissible dose of 10^8 rad is chosen because, while it is large enough that a measurable amount of damage will be done to the resin, it is small enough that the damage will be negligible at a power plant or disposal site. A test procedure has been written which a generator could use to qualify a specific resin for service at a higher dose than permitted by the general rule.

5937 **(NUREG/CR—3548) Hazardous-material accidents near nuclear power plants: an evaluation of analyses and approaches.** Kot, C.A.; Lin, H.C.; van Erp, J.B.; Eichler, T.V.; Wiedermann, A.H. (Argonne National Lab., IL (USA); ATResearch Associates, Glen Ellyn, IL (USA)). Oct 1983. Contract W-31-109-ENG-38. 164p. (ANL—83-53). NTIS, PC A08/MF A01 - GPO. Order Number DE84002387.

The state of knowledge concerning postulated accidents involving offsite hazardous materials in the vicinity of nuclear power plants is critically evaluated. This effort is part of a study to analyze the potential effects of offsite hazards upon the safety of nuclear power plants and to develop a technical basis for the assessment of siting approaches. The evaluation includes consideration of data bases and statistics of hazardous materials and accidents involving them, deterministic aspects of possible material dispersion and threat environments, the susceptibility and vulnerability of vital plant systems, and a critical review of past licensing experience and regulatory practice with respect to these hazards. While many of the data bases and analysis methods exist for an adequate estimate of threat and plant response, this knowledge is not fully used and no comprehensive guidance has been developed. Siting of nuclear power plants relative to offsite hazardous materials is a risk based procedure that considers both probabilities and consequences of events that make up accident scenarios. In this context it appears feasible to improve the procedures vis-a-vis the perception of safety, economy of effort, and efficiency of implementation. A scenario dependent conditional risk approach is outlined as a possible means of improving the siting procedures.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 5926, 5968, 5979

5938 **(CONF-830609—60) Application of ^{252}Cf-source driven noise analysis measurements for subcriticality of HFIR fuel elements.** King, W.T.; Mihalczo, J.T. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 7p. NTIS, PC A02/MF A01. Order Number DE84003196.

From ANS annual meeting; Detroit, MI, USA (12 Jun 1983).

The approach-to-critical measurements reported were for a plate-type fuel element where the height of the water moderator and side and top reflector were increased. Measurements were also performed with each of the two annuli of the fuel element to verify both the presence of boron in the fuel plates and the proper uranium loading prior to assembly of the two annuli for full submersion measurements. Measurements were also performed with detectors external to the reflector (> 15 cm of water on top, bottom, and side) for the assembled, submerged HFIR fuel element.

5939 **(CONF-830942—21) National Low-Temperature Neutron-Irradiation Facility.** Coltman, R.R. Jr.; Klabunde, C.E.; Young, F.W. Jr. (Oak Ridge National Lab., TN (USA)). Aug 1983. Contract W-7405-ENG-26. 3p. NTIS, PC A02/MF A01. Order Number DE84000729.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

The Materials Sciences Division of the United States Department of Energy will establish a National Low Temperature Neutron Irradiation Facility (NLTNIF) which will utilize the Bulk Shielding Reactor (BSR) located at Oak Ridge National Laboratory. The facility will provide high radiation intensities and special environmental and testing conditions for qualified experiments at no cost to users. This report describes the planned experimental capabilities of the new facility.

5940 **(CONF-831012—3) Interaction between users of large and small research reactors.** Moon, R.M. (Oak Ridge National Lab., TN (USA)). Oct 1983. Contract W-7405-ENG-26. 9p. NTIS, PC A02/MF A01. Order Number DE84001987.

From International symposium on use and development of low and medium flux research reactors; Cambridge, MA, USA (17 Oct 1983).

An attitude of cooperation rather than competition should and does exist between large and small reactor centers with regard to neutron scattering. Two areas of clear mutual interest are the development of user communities and the development of improved instrumentation. The current situation in Europe and the United States is examined and contrasted for these two areas. A recommendation is advanced for increased cooperation in the US between large and small reactor centers in the education and training of neutron scattering users.

5941 **(CONF-8310176—2) Comparison of the Aerospace Systems Test Reactor loss-of-coolant test data with predictions of the 3D-AIRLOCA code.** Warinner, D.K. (Argonne National Lab., IL (USA); Oak Ridge National Lab., TN (USA)). 1983. Contract W-31-109-ENG-38. 10p. NTIS, PC A02/MF A01. Order Number DE84003623.

From International meeting on reduced enrichment for research and test reactors; Tokai, Japan (24 Oct 1983).

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This paper compares the predictions of the revised 3D-AIRLOCA computer code to those data available from the Aerospace Systems Test Reactor's (ASTR's) loss-of-coolant-accident (LOCA) tests run in 1964. The theoretical and experimental hot-spot temperature responses compare remarkably well. In the thirteen cases studied, the irradiation powers varied from 0.4 to 8.87 MW; the irradiation times were 300, 1540, 1800, and 10^4 s. The degrees of agreement between the data and predictions provide an experimental v lidation of the 3D-AIRLOCA code.

5942 **(CONF-8310176—3) Nuclear criticality assessment of LEU and HEU element storage.** Pond, R.B.; Matos, J.E. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01. Order Number DE84003617.

From International meeting on reduced enrichment for research and test reactors; Tokai, Japan (24 Oct 1983).

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Criticality aspects of storing LEU (20%) and HEU (93%) fuel elements have been evaluated as a function of ^{235}U loading, element geometry, and fuel type. Silicide, oxide, and aluminide fuel types have been evaluated ranging in ^{235}U loading from 180 to 620 g per element and from 16 to 23 plates per element. Storage geometry considerations have been evaluated for fuel element separations ranging from closely packed formations to spacings of several centimeters between elements. Data are presented in a form in which interpolations may be made to estimate the eigenvalue of any fuel element storage configuration that is within the range of the data.

5943 **(CONF-8310176—4) Recent developments of the US RERTR program.** Travelli, A. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01. Order Number DE84003679.

From International meeting on reduced enrichment for research and test reactors; Tokai, Japan (24 Oct 1983).

The status of the US Reduced Enrichment Research and Test Reactor (RERTR) Program is reviewed. After a brief outline of the RERTR Program objectives, goals and past accomplishments, emphasis is placed on the developments which took place during 1983 and on current program plans and schedules. Most program activities have proceeded as planned and a combination of two silicide fuels (U_3Si_2-Al and U_3Si-Al) was found to hold excellent promise for achieving the long-term program goals. A modification of the program plan, including the development and demonstration of those fuels, was prepared and is now being implemented. The uranium density of qualified RERTR fuels for plate-type reactors is forecasted to grow by approximately 1 g U/cm^3 each year, from the current 1.7 g U/cm^3 to the 7.0 g U/cm^3 which will be reached in 1988. The technical needs of research reactors for HEU exports are also forecasted to undergo a gradual and dramatic decline in the coming years.

5944 **(CONF-8310176—6) Fuel development activities of the US RERTR Program.** Snelgrove, J.L.; Domagala, R.F.; Wiencek, T.C.; Copeland, G.L. (Argonne National Lab., IL (USA); Oak Ridge National Lab., TN (USA)). 1983. Contract W-31-109-ENG-38. 10p. NTIS, PC A02/MF A01. Order Number DE84003620.

From International meeting on reduced enrichment for research and test reactors; Tokai, Japan (24 Oct 1983).

Progress in the development and irradiation testing of high-density fuels for use with low-enriched uranium in research and test reactors is reported. Swelling and blister-threshold temperature data obtained from the examination of miniature fuel plates containing UAl/sub x/, U_3O_8, U_3Si_2, or U_3Si dispersed in an aluminum matrix are presented. Combined with the results of metallurgical examinations, these data show that these four fuel types will perform adequately to full burnup of the ^{235}U contained in the low-enriched fuel. The exothermic reaction of the uranium-silicide fuels with aluminum has been found to occur at about the same temperature as the melting of the aluminum matrix and cladding and to be essentially quenched by the melting endotherm. A new series of miniature fuel plate irradiations is also discussed.

5945 **(CONF-8310176—7) Irradiation testing of full-sized, reduced-enrichment fuel elements.** Snelgrove, J.L.; Copeland, G.L. (Argonne National Lab., IL (USA); Oak Ridge National Lab., TN (USA)). 1983. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01. Order Number DE84003547.

From International meeting on reduced enrichment for research and test reactors; Tokai, Japan (24 Oct 1983).

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The current status of the irradiation testing of full-sized, reduced-enrichment fuel elements and fuel rods under the US Reduced Enrichment Research and Test Reactor Program is reported. Being tested are UAl/sub x/-Al, U_3O_8-Al, U_3Si_2-Al, and U_3Si-Al dispersion fuels and UZrH/sub x/ (TRIGA) fuel at uranium densities in the fuel meat ranging from 1.7 to 6.0 Mg/m^3. Generally good performance has been experienced to date. Some preliminary results of postirradiation examinations are also included. A whole-core demonstration in the Oak Ridge Research Reactor is planned. Some details of this demonstration are provided.

5946 **(EGG-M—04983) LOFT transient analysis with real-time, minicomputer-based simulation.** Hyer, F.K.; Tylee, J.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 9p. (CONF-830901—21). NTIS, PC A02/MF A01. Order Number DE84002892.

From Anticipated and abnormal plant transients in light water reactors conference; Jackson, WY, USA (26 Sep 1983).

A digital computer simulation of the LOFT (Loss-of-Fluid Test) plant is described and evaluated. The real-time simulation, which predicts dynamic response to both normal and abnormal operating conditions, is implemented on a PDP 11/55 minicomputer. The simulation models the following components: reactor core, primary vessel, primary coolant loop, pressurizer, plant protection system, high pressure injection, steam generator, air-cooled condenser, condensate receiver, feedwater subcooler, steam generator water level control system, and condenser pressure controller. The phenomenological fidelity of the simulation is demonstrated using data from the LOFT L6-5 loss-of-feedwater experiment.

5947 **(EGG-M—13683) Extended life aluminide fuel for university research reactors.** Miller, L.G.; Brown, K.R.; Beeston, J.M.; McGinty, D.M. (EG and G Idaho, Inc., Idaho Falls (USA); Missouri Univ., Columbia (USA)). 1983. Contract AC07-76ID01570. 10p. (CONF-831012—6). NTIS, PC A02/MF A01. Order Number DE84003808.

From International symposium on use and development of low and medium flux research reactors; Cambridge, MA, USA (17 Oct 1983).

A test program is being conducted to determine if the fuel loading and burnup limits for fuel elements in university research reactors can be safely increased beyond the limits presently allowed by reactor licensing restrictions. For the tests, 30 fuel plates were constructed to a maximum fuel loading which could be produced on a commercial basis and to contain a maximum boron content as used in the Advanced Test Reactor to reduce initial reactor reactivity. A UAl_3 fuel matrix was used to gain higher uranium content. The test program planned for the fuel plates to be irradiated to a 3.3 x 10^{21} fissions/cm^3 average burnup (45% of U-235 for the 50 vol% fuel plate cores). This would be twice the burnup presently allowed in the university reactors. Irradiation performance of the heavy loaded fuel plates has been good at burnups exceeding 2.3 x 10^{21} fissions/cm^3, with one fuel plate reaching a peak burnup of about 3 x 10^{21} fissions/cm^3. Three fuel plates failed, however, during the irradiation, and are undergoing destructive analysis. Corrosion pitting occurred in cladding of both UAl_3 and UAl_3 fuel plates. Some plates appear to be more resistant to corrosion pitting than others. Localized swelling in high fuel loaded plates also is being investigated as a possible failure mode.

5948 **(NUREG—1016) Safety-evaluation report related to the renewal of the operating license for the research reactor at the Iowa State University (Docket No. 50-116).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Sep 1983. 85p. NTIS, PC A05/MF A01 - GPO $4.75. Order Number DE84900034.

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This Safety Evaluation Report for the application filed by the Iowa State University (ISU) for a renewal of the Class 104 Operating License R-59 to continue to operate its Argonaut-type research reactor has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. The facility is owned and operated by the Iowa State University, and is located on the ISU campus in Ames, Story County, Iowa. The staff concludes that the reactor facility can continue to be operated by ISU without endangering the health and safety of the public. The principal matters reviewed are: design, testing, and performance of the reactor components and systems; the expected consequences of credible accidents; the licensee's management organization; the

method used for the control of radiological effluents; the licensee's technical specifications; financial data and information; the physical protection program; procedures for training reactor operators; and emergency plans. 11 references, 15 figures, 13 tables.

5949 **(BNL-tr—1015) Results of the examination of channel H12/1.** Bauer, E. (Brookhaven National Lab., Upton, NY (USA); Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)). Jan 1983. Contract AC02-76CH00016. Translation of RHF No. 106, January 20, 1983. 49p. NTIS, PC A03/MF A01. Order Number DE84004551.

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Channel H12/1 is one part of the channel unit of the High-Flux Reactor that has been affected by corrosion attack. It was disassembled after the appearance of a heavy water leak and examined in a hot cell. Results of the examination are presented. (DLC)

5950 **(BNL-tr—1016) Description of marks observed on channel H13/1.** Bauer, E. (Brookhaven National Lab., Upton, NY (USA); Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)). Mar 1982. Contract AC02-76CH00016. Translation of RHF No. 101, March 15, 1982. 30p. NTIS, PC A03/MF A01. Order Number DE84004552.

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Channel H13/1 is part of the channel unit of the High Flux Reactor characterized by average corrosion attack. Metallography reveal two types of corrosion: in-depth caving corrosion, and surface cracks. (DLC)

5951 **(BNL-tr—1017) Description of the marks observed on the irradiated V7/1 tube.** Bauer, E. (Brookhaven National Lab., Upton, NY (USA); Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)). Nov 1981. Contract AC02-76CH00016. Translation of RHF No. 97, November 13, 1981. 31p. NTIS, PC A03/MF A01. Order Number DE84004553.

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Surface phenomena have been revealed during performance of the third portion of the AG3 NET - RHF test program. These phenomena are reflected by a cracking of the material at the limits between the grains involving the exterior portions of tube V7 that were exposed to a very intense radiation in contact with the heavy water in the reactor. The depth of the zone involved is between 1mm and and several dozen millimeters. The portions in contact with the helium are free of the phenomenon.

2207 Plutonium And Isotope Production Reactors

REFER ALSO TO CITATION(S) 5961

5952 **(DPST—83-639) Increased SRP reactor power.** MacAfee, I.M. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 29 Jun 1983. Contract AC09-76SR00001. 6p. NTIS, PC A02/MF A01. Order Number DE84003686.

Major changes in the current reactor hydraulic systems could be made to achieve a total of about 1500 MW increase of reactor power for P, K, and C reactors. The changes would be to install new, larger heat exchangers in the reactor buildings to increase heat transfer area about 24%, to increase H_2O flow about 30% per reactor, to increase D_2O flow 15 to 18% per reactor, and increase reactor blanket gas pressure from 5 psig to 10 psig. The increased reactor power is possible because of reduced inlet temperature of reactor coolant, increased heat removal capacity, and increased operating pressure (larger margin from boiling). The 23% reactor power increase, after adjustment for increased off-line time for reactor reloading, will provide a 15% increase of production from P, K, and C reactors. Restart of L Reactor would increase SRP production 33%.

2209 Reactor Safety

REFER ALSO TO CITATION(S) 5827, 6008

5953 **(BNL-NUREG—33809) Dose reduction at nuclear power plants.** Baum, J.W.; Dionne, B.J. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 20p. (CONF-8310143—53). NTIS, PC A02/MF A01 - GPO. Order Number DE84002870.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The collective dose equivalent at nuclear power plants increased from 1250 rem in 1969 to nearly 54,000 rem in 1980. This rise is attributable primarily to an increase in nuclear generated power from 1289 MW-y to 29,155 MW-y; and secondly, to increased average plant age. However, considerable variation in exposure occurs from plant to plant depending on plant type, refueling, maintenance, etc. In order to understand the factors influencing these differences, an investigation was initiated to study dose-reduction techniques and effectiveness of as low as reasonably achievable (ALARA) planning at light water plants. Objectives are to: identify high-dose maintenance tasks and related dose-reduction techniques; investigate utilization of high-reliability, low-maintenance equipment; recommend improved radioactive waste handling equipment and procedures; examine incentives for dose reduction; and compile an ALARA handbook.

5954 **(BNL-NUREG—33896) Assessment of uncertainties in core melt phenomenology and their impact on risk at the Z/IP facilities.** Pratt, W.T.; Ludewig, H.; Bari, R.A.; Meyer, J.F. (Brookhaven National Lab., Upton, NY (USA); Nuclear Regulatory Commission, Washington, DC (USA)). 1983. Contract AC02-76CH00016. 6p. (CONF-830816—48). NTIS, PC A02/MF A01 - GPO. Order Number DE84003850.

From International meeting on light-water reactor severe accident evaluation; Cambridge, MA, USA (28 Aug 1983).

An evaluation of core meltdown accidents in the Z/IP facilities has been performed. Containment event trees have been developed to relate the progression of a given accident to various potential containment building failure modes. An extensive uncertainty analysis related to core melt phenomenology has been performed. A major conclusion of the study is that large variations in parameters associated with major phenomenological uncertainties have a relatively minor impact on risk when external initiators are considered. This is due to the inherent capability fo the Z/IP containment buildings to contain a wide range of core meltdown accidents. 12 references, 2 tables.

5955 **(CONF-801053—13) In-vessel instrumentation for high-temperature transient two-phase flows.** Eads, B.G. (Oak Ridge National Lab., TN (USA)). 1980. Contract W-7405-ENG-26. 15p. NTIS, PC A02/MF A01. Order Number DE84003321.

From 8. water reactor safety research information meeting; Gaithersburg, MD, USA (27 Oct 1980).

A program was initiated in 1977 to develop instrumentation for measurement of in-vessel local fluid phenomena in safety experiments designed to investigate the refill and reflood phases of the PWR loss-of-coolant accident. Objective is to develop techniques and systems for measuring fluid flow in-core, deentrainment in the upper plenum, liquid fallback from the upper plenum into the core, and flow across the core-upper plenum interface.

5956 **(CONF-830609—61) SEP operating history of the Dresden Nuclear Power Station Unit 2.** Mays, G.T.; Harrington, K.H. (Oak Ridge National Lab., TN (USA); JBF Associates, Knoxville, TN (USA)). 1983. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE84003160.

From ANS annual meeting; Detroit, MI, USA (12 Jun 1983).

206 forced shutdowns and power reductions were reviewed, along with 631 reportable events and other miscellaneous documentation concerning the operation of Dresden-2, in order to indicate those areas of plant operation that compromised plant safety. The

most serious plant challenge to plant safety occurred on June 5, 1970; while undergoing power testing at 75% power, a spurious signal in the reactor pressure control system caused a turbine trip followed by a reactor scram. Subsequent erratic water level and pressure control in the reactor vessel, compounded by a stuck indicator pen on a water level monitor-recorder and inability of the isolation condenser to function, led to discharge of steam and water through safety valves into the reactor drywell. No significant contamination was discharged. There was no pressure damage or the reactor vessel of the drywell containment walls. Six areas of operation that should be of continued concern are diesel generator failures, control rod and rod drive malfunctions, radioactive waste management/health physics program problems, operator errors, turbine control valve and EHC problems, and HPCI failures. All six event types have continued to recur.

5957 **(CONF-830818—7) SEP operating history review of the Millstone Unit 1 Nuclear Power Plant.** Mays, G.T.; Harrington, K.H.; Muhlheim, M.D. (Oak Ridge National Lab., TN (USA); JBF Associates, Knoxville, TN (USA)). 1983. Contract W-7405-ENG-26. 8p. NTIS, PC A02/MF A01. Order Number DE84003298.

From 11. biennial topical conference on reactor operating experience - plant startup and operations in the 80's; Scottsdale, AZ, USA (1 Aug 1983).

The Systematic Evaluation Program Branch of the NRC is conducting the Systematic Evaluation Program (SEP) for the purpose of determining the safety margins of the design and operation of ten of the older operating commercial nuclear power plants in the United States. This summary presents the results from the review of the operating history of the Millstone Unit 1 Nuclear Power Plant.

5958 **(CONF-8310143—56) Maintenance personnel performance simulation (MAPPS): a model for predicting maintenance performance reliability in nuclear power plants.** Knee, H.E.; Krois, P.A.; Haas, P.M.; Siegel, A.I.; Ryan, T.G. (Oak Ridge National Lab., TN (USA); Applied Psychological Services, Inc., Wayne, PA (USA); Nuclear Regulatory Commission, Washington, DC (USA)). 1983. Contract W-7405-ENG-26. 13p. NTIS, PC A02/MF A01. Order Number DE84003293.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The NRC has developed a structured, quantitative, predictive methodology in the form of a computerized simulation model for assessing maintainer task performance. Objective of the overall program is to develop, validate, and disseminate a practical, useful, and acceptable methodology for the quantitative assessment of NPP maintenance personnel reliability. The program was organized into four phases: (1) scoping study, (2) model development, (3) model evaluation, and (4) model dissemination. The program is currently nearing completion of Phase 2 - Model Development.

5959 **(CONF-8310144—4) Fission-gas-bubble mobility in oxide fuel: a critical analysis.** Tam, S.W.; Johnson, C.E. (Argonne National Lab., IL (USA)). Aug 1983. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01. Order Number DE84000596.

From Specialists' workshop on fission gas behavior in safety experiments; Cadarache, France (5 Oct 1983).

The available volatile fission product release data has confirmed the general viability of the scaling model of volatile fission product release in which the fractional release rates of the volatile fission products scale as that of the fission gas. The question of whether fission gas bubbles can move sufficiently fast to be a significant mechanism responsible for fission gas release from the fuel is considered. The mean jump distance per jump of the hopping process in gas bubble motion is analyzed. Surface roughness is also considered.

5960 **(DOE/S—0024) Light-water reactor research and development reactor safety R and D.** (USDOE Office of Energy Research, Washington, DC. Energy Research Advisory Board). Sep 1983. 53p. NTIS, PC A04/MF A01. Order Number DE84003567.

The Energy Research Advisory Board (ERAB) was requested to under take an examination of safety research and development (R and D) on light water reactors (LWRs) in order to advise the Department of Energy (DOE) on the adequacy of those efforts for making effective use of nuclear power. In carrying out this examination, DOE asked that ERAB: (1) review the adequacy of DOE's LWR safety R and D management plan prepared pursuant to Public Law 96-567, (2) examine the safety-related R and D conducted by the various government and nongovernment groups, and (3) identify R and D that could result in major design improvements to LWRs. To carry out this examination, ERAB appointed an expert panel. This report contains the results of ERAB's examination of the first two of the above subjects. The Board has yet to consider the subject of nonsafety-related long-term LWR R and D, as also requested by DOE. Furthermore, in keeping with the Department's guidance, this report does not include an examination of the R and D on related activities such as reprocessing, waste management, and the breeder.

5961 **(DPST—82-810) Users guide for NRC145-2 accident assessment computer code.** Pendergast, M.M. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). Aug 1982. Contract AC09-76SR00001. 31p. NTIS, PC A03/MF A01. Order Number DE84003479.

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An accident assessment computer code has been developed for use at the Savannah River Plant. This computer code is based upon NRC Regulatory Guide 1.145 which provides guidence for accident assessements for power reactors. The code contains many options so that the user may utilize the code for many different assessments. For example the code can be used for non-nuclear assessments such as Sulpher Dioxide which may be required by the EPA. A discription of the code is contained in DP-1646. This document is a compilation of step-by-step instructions on how to use the code on the SRP IBM 3308 computer. This document consists of a number of tables which contain copies of computer listings. Some of the computer listings are copies of input; other listings give examples of computer output.

5962 **(EGG-M—09383) Safety parameter display systems' effect on operator performance.** Cerven, F.; Ford, R.E.; Blackman, H.S. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 5p. (CONF-830901—11). NTIS, PC A02/MF A01. Order Number DE84000802.

From Anticipated and abnormal plant transients in light water reactors conference; Jackson, WY, USA (26 Sep 1983).

Computer generated displays are a powerful and flexible tool for presenting data to the operators of nuclear power plants. Such displays are currently being developed in industry for use as safety parameter displays and for use in advanced control rooms. There exists a need for methods to objectively evaluate the effect of these displays, positive or negative, on the performance of control room personnel. Results of developing one such method, noninteractive simulation, and the two experiments that were performed to determine if it can be used as a method for evaluating computer displays are presented. This method is more objective and powerful than pencil and paper methods because it measures human performance rather than opinion or perference, has excellent control of the experimental variables, and has a higher fidelity to the control room environment. The results of these experiments indicates that the present methodology does not differentiate among the display types tested at a statistically significant level. In other words, all display types tested worked equally well in providing operators needed information.

5963 **(EGG-M—15983) Low-level waste volumes from decommissioning of commercial nuclear power plants.** Clark, J.H.; Sneed, B.J. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 5p. (CONF-831047—103). NTIS, PC A02/MF A01. Order Number DE84002767.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

The decommissioning of commercial nuclear power reactors will begin about the year 2000 and is expected to continue beyond

2045. That decommissioning will generate significant volumes of low-level radioactive waste. Seventy-seven such facilities are now operating or have operated in the US, and 70 more are expected to be operating by the year 2000. The low-level wastes from decommissioning of these facilities must be accomodated in emerging state and regional low-level waste disposal sites. Accurate projections of the annual decommissioning waste volumes must be available for developing disposal site plans. A method for estimating low-level waste volumes from decommissioning of individual power plants is described which utilizes several existing information sources.

5964 **(EGG-M—22683) Fission gas and iodine release measured up to 15 GWd/t UO_2 burnup.** Appelhans, A.D. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 7p. (CONF-8310143—47). NTIS, PC A02/MF A01. Order Number DE84002202.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

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A summary is presented of the measured release of xenon, krypton and iodine up to 15 GWd/t UO_2 burnup for fuel centerline temperatures ranging from 950 to 1800 K, at average linear heat ratings of 15 to 35 kW/m. The IFA-430 is composed of four 1.28-m-long fuel rods containing 10% enriched UO_2 pellet fuel. Two of the fuel rods are connected, top and bottom, to a gas flow system that permits the fission gases released from the fuel pellets to be swept out of the rods during irradiation and measured via gamma spectrometry. The release/burnup increased significantly between 10 and 15 GWd/t burnup. Fuel temperature did not change. Increased releases were due to physical changes in the fuel-surface area. Changes appeared to be due to higher power operation and burnup.

5965 **(EGG-TMI—M00583) Acquisition of TMI-2 core debris samples.** Owen, D.E.; Fee, D.S.; Bower, J.M. (EG and G Idaho, Inc., Idaho Falls (USA); EG and G, Inc., Middletown, PA (USA)). 1983. Contract AC07-76ID01570. 6p. (CONF-831047—111). NTIS, PC A02/MF A01. Order Number DE84002893.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

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Recently the first samples of material were obtained from the damaged TMI-2 reactor core. This paper reviews the design and operation of the specialized equipment used to acquire these samples. In addition to two unique core debris rubble bed samplers, a 14-m-long sampler deployment boom, radiation shielding, and sample casks were designed and fabricated for the task. Analysis of the six TMI-2 core debris specimens obtained are presently underway at several laboratories, and the analysis plans are presented.

5966 **(ESG-DOE—13414) SP-100 Program: space reactor system and subsystem investigations.** Harty, R.B. (Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group). 30 Sep 1983. Contract AT03-82SF11687. 59p. NTIS, PC A04/MF A01. Order Number DE84003217.

For a space reactor power system, a comprehensive safety program will be required to assure that no undue risk is present. This report summarizes the nuclear safety review/approval process that will be required for a space reactor system. The documentation requirements are presented along with a summary of the required contents of key documents. Finally, the aerospace safety program conducted for the SNAP-10A reactor system is summarized. The results of this program are presented to show the type of program that can be expected and to provide information that could be usable in future programs.

5967 **(INIS-mf—8255) Test to prove the resistance to incidents of components of electric and control systems in the safety containment of nuclear power plants.** (Vereinigung der Technischen Ueberwachungsvereine e.V., Essen (Germany, F.R.). TUeV-Leitstelle Kerntechnik). 15 Jun 1982. 23p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704635.

The marginal program for proving the suitability of safety-relevant components of electric and control systems in the safety containment during a loss-of-coolant incident is described. Variant test conditions are established in the component-specific test program. Special attention has been paid to the representation of the course of pressure and temperature for the performance test of the valve room of the Nuclear Power Plant Philippsburg 2.

5968 **(NUREG—0849(83)) Standard review plan for the review and evaluation of emergency plans for research and test reactors.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Inspection and Enforcement). Oct 1983. 29p. NTIS, PC A03/MF A01 - GPO $3.75. Order Number DE84900245.

This document provides a Standard Review Plan to assure that complete and uniform reviews are made of research and test reactor radiological emergency plans. The report is organized under ten planning standards which correspond to the guidance criteria in American National Standard ANSI/ANS 15.16 - 1982 as endorsed by Revision 1 to Regulatory Guide 2.6. The applicability of the items under each planning standard is indicated by subdivisions of the steady-state thermal power levels at which the reactors are licensed to operate. Standard emergency classes and example action levels for research and test reactors which should initiate these classes are given in an Appendix. The content of the emergency plan is as follows: the emergency plan addresses the necessary provisions for coping with radiological emergencies. Activation of the emergency plan is in response to the emergency action levels. In addition to addressing those severe emergencies that will fall within one of the standard emergency classes, the plan also discusses the necessary provisions to deal with radiological emergencies of lesser severity that can occur within the operations boundary. The emergency plan allows for emergency personnel to deviate from actions described in the plan for unusual or unanticipated conditions.

5969 **(NUREG/CR—2000-Vol.2-No.10) Licensee Event Report (LER) compilation for month of October 1983. Vol. 2, No. 10.** (Oak Ridge National Lab., TN (USA)). Nov 1983. Contract W-7405-ENG-26. 152p. (ORNL/NSIC—200-Vol.2-No.10). NTIS, PC A08/MF A01 - GPO. Order Number DE84003766.

This monthly report contains Licensee Event Report (LER) operational information that was processed into the LER data file of the Nuclear Safety Information Center (NSIC). The LERs are submitted to the Nuclear Regulatory Commission (NRC) by nuclear power plant licensees in accordance with federal regulations. The LER summaries in this report are arranged alphabetically by facility name and then chronologically by event date for each facility. Component, system, keyword, and component vendor indexes follow the summaries. The components, systems, and vendors are those identified by the utility when the LER form is initiated.

5970 **(NUREG/CR—3266) Seismic and dynamic qualification of safety-related electrical and mechanical equipment in operating nuclear power plants: development of a method to generate generic floor-response spectra.** Curreri, J.; Costantino, C.; Subudhi, M.; Reich, M. (Brookhaven National Lab., Upton, NY (USA)). Sep 1983. Contract AC02-76CH00016. 103p. (BNL-NUREG—51667). NTIS, PC A06/MF A01 - GPO $4.75. Order Number DE84001377.

Generic floor response spectra were developed for use in the qualification of electrical and mechanical equipment in operating nuclear power plants. The characteristics of 1000 floor response spectra were studied to determine the generic spectra. The procedure developed uses as much or as little information that currently exists at the plant relating to the question of equipment qualification. The general approach was to study the effects on the dynamic characteristics of each of the elements in the chain of events that goes between the loads and the responses. This includes the loads, the soils and the structures. A free-field earthquake response spectra was used to generate horizontal earthquake time histories. The excitation was applied through the soil and into the various structures to produce responses in equipment. An entire range of soil conditions was used with each structure. Actual PWR and BWR - Mark I structural models were used. For each model, the stiffness properties were varied, with the same mass, so as to extend the fundamental base structure natural frequency from 2 cps to 36 cps.

The natural frequencies of the structures were varied to obtain maximum response conditions. The actual properties were first used to locate the natural frequencies. The stiffness properties were than varied, with the same mass, to extend the range of the fundamental base structure natural frequency. The intention was to have the coupled structural material frequencies in the vicinity of the peak amplitude frequency content of the excitation spectrum. Particular attention was therefore given to the frequency band between 2 Hz and 4 Hz. A horizontal generic floor response spectra is proposed for the top level of a generic structure. Reduction factors are applied to the peak acceleration for equipment at lower levels.

5971 **(NUREG/CR—3297) Review of the Catawba Units 1 and 2 auxiliary feedwater system reliability analysis.** Fresco, A.; Youngblood, R.; Papazoglou, I.A. (Brookhaven National Lab., Upton, NY (USA)). Oct 1983. Contract AC02-76CH00016. 108p. (BNL-NUREG—51675). NTIS, PC A06/MF A01 - GPO $4.75. Order Number DE84004560.

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This report presents the results of a review of the Auxiliary Feedwater System Reliability Analysis for Catawba Units 1 and 2. The objective of this report is to estimate the probability that the Auxiliary Feedwater System will fail to perform its mission for each of three different initiators: (1) loss of main feedwater with offsite power available, (2) loss of offsite power, (3) loss of all ac power except for vital instrumentation and control power. The scope, methodology, and failure data are prescribed by NUREG-0611, Appendix III. The results are compared with those obtained in NUREG-0611 for other Westinghouse plants.

5972 **(NUREG/CR—3312) Effects of the reactor coolant pumps following a small break in a Westinghouse PWR.** Koenig, J.E. (Los Alamos National Lab., NM (USA)). Oct 1983. Contract W-7405-ENG-36. 62p. (LA—9784-MS). NTIS, PC AA04/MF A01 - GPO. Order Number DE84003111.

Numerical simulations of the thermal-hydraulic events following a small cold-leg break in a Westinghouse pressurized water reactor were performed to address the pumps-on/off issue. The mode of pump operation was varied in each calculation to ascertain the optimum mode. It was found that pump operation was not critical for this break size and location because the fuel rods remained cool in all accidents analyzed. In terms of system mass, however, it was preferable to leave the pumps in operation.

5973 **(NUREG/CR—3428) Application of the SSMRP methodology to the seismic risk at the Zion Nuclear Power Plant.** Bohn, M.P.; Shieh, L.C.; Wells, J.E.; Cover, L.C.; Bernreuter, D.L.; Chen, J.C.; Johnson, J.J.; Bumpus, S.E.; Mensing, R.W.; O'Connell, W.J. (Lawrence Livermore National Lab., CA (USA)). Nov 1983. Contract W-7405-ENG-48. 320p. (UCRL—53483). NTIS, PC A14/MF A01 - GPO. Order Number DE84003729.

The Seismic Safety Margins Research Program (SSMRP) has the goal of developing a fully coupled analysis procedure for estimating the risk of an earthquake-induced radioactive release from a commercial nuclear power plant. The risk analysis included a detailed seismological evaluation of the region around Zion, Illinois, which provided the earthquake-hazard function and a randomized set of 180 time histories (having peak ground acceleration values up to 1.8 g). These time histories were used as input for dynamic structural response calculations for four different Zion buildings. Detailed finite-element models of the buildings were used. Calculated time histories at piping support points were then used to determine moments throughout critical piping systems. Twenty separate piping models were analyzed. Finally, the responses of piping and safety system components within the buildings were combined with probabilistic failure criteria and event-tree/fault-tree models of the plant safety systems to produce an estimate of the frequency of core melt and radioactive release due to earthquakes.

5974 **(NUREG/CR—3525) Mechanistic core-wide meltdown and relocation modeling for BWR applications.** Podowski, M.Z.; Taleyarkhan, R.P.; Lahey, R.T. Jr. (Rensselaer Polytechnic Inst., Troy, NY (USA)). Dec 1983. Contract W-7405-ENG-26. 80p. (ORNL/Sub—81-9089/1). NTIS, PC A05/MF A01 - GPO. Order Number DE84004921.

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This report summarizes the results of developmental work of methods of core modeling for use in the analyses of the progression of accidents that involve core damage in BWRs. Accomplishments include the development of an analytical model for channel box and control rod heatup, oxidation, and melting and a mechanistic core-wide meltdown and relocation model. These are provided in the form of a FORTRAN subroutine denoted MELRPI that can be exercised with an existing version of the MARCH code. The modeling concept and the modular structure employed in MELRPI have been designed so that new models subsequently developed for specific phenomena can be rapidly incorporated when they become available.

5975 **(NUREG/CR—3527) Material transport analysis for accident-induced flow in nuclear facilities.** Martin, R.A.; Tang, P.K.; Harper, A.P.; Novat, J.D.; Gregory, W.S. (Los Alamos National Lab., NM (USA)). Oct 1983. Contract W-7405-ENG-36. 85p. (LA—9913-MS). NTIS, PC A05/MF A01 - GPO. Order Number DE84004260.

This report is a summary of the material transport modeling procedures developed to support a family of accident analysis computer codes. The material transport modeling areas include transport initiation, convection, interaction, depletion, and filtration. Except for material interaction, these areas are developed in modular form in three Los Alamos National Laboratory computer codes: TORAC, EXPAC, and FIRAC. This family of codes was developed to provide improved methods of tornado, explosion, and fire accident consequence assessment, respectively, for the nuclear industry. Although the codes were designed to estimate accident-induced gas-dynamic, thermal, and material transport transient phenomena in nuclear fuel cycle facility ventilation systems, they are applicable to other faciliites as well. Sample problems using TORAC have been provided to illustrate the current material transport capabilities for a simple system under tornado-induced accident conditions. Some suggestions for future improvements to some of these material transport models also are discussed.

5976 **(PNL-SA—11307) Battelle's human factors program for the US Nuclear Regulatory Commission.** Shikiar, R. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1983. Contract AC06-76RL01830. 11p. (CONF-831036—1). NTIS, PC A02/MF A01. Order Number DE84002593.

From Nuclear facilities operator training topical meeting; Madrid, Spain (19 Oct 1983).

Battelle has been involved in a programmatic effort of technical assistance to the Division of Human Factors Safety of the NRC. This program involves the efforts of over 75 professionals engaged in over 20 projects. These projects span the areas of human factors engineering, procedures, examinations, training, staffing and qualifications, and utility management and organization. All of these bear, one way or another, on the role of operators in nuclear power plants. This programmatic effort can be viewed as part of an integrative approach to system safety.

5977 **(PNL-SA—11599) Selection/licensing of nuclear power plant operators.** Saari, L.M. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1983. Contract AC06-76RL01830. 8p. (CONF-8308100—5). NTIS, PC A02/MF A01. Order Number DE84000149.

From 91. annual meeting of the American Psychological Association; Anaheim, CA, USA (27 Aug 1983).

An important aspect of nuclear power plant (NPP) safety is the reactor operator in the control room. The operators are the first individuals to deal with an emergency situation, and thus, effective performance on their part is essential for safe plant operations. Important issues pertaining to NPP reactor operators would fall within the personnel subsystem of our safety system analysis. While there are many potential aspects of the personnel subsystem, a key

first step in this focus is the selection of individuals - attempting to choose individuals for the job of reactor operator who will safely perform the job. This requires a valid (job-related) selection process. Some background information on the Nuclear Regulatory Commission (NRC) licensing process used for selecting NPP reactor operators is briefly presented and a description of a research endeavor now underway at Battelle for developing a valid reactor operator licensing examination is included.

5978 **(SAND—83-1862C) Mitigation of damaging effects of hydrogen combustion in nuclear power plants.** Nelson, L.S.; Berman, M. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 24p. (CONF-8310143—27). NTIS, PC A02/MF A01. Order Number DE84002385.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

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Various systems and concepts are being investigated for reducing or eliminating the damage to reactor containment or safety equipment caused by hydrogen combustion. An overview of analytical and experimental programs is presented. Topics summarized include: deliberate ignition. deliberate ignition with pressure suppression, deliberate flaring, nonpowered igniters, and modification of plant atmospheres.

5979 **(LA-tr—83-22) Studies of criticality accidents in solution carried out in the SILENE reactor: phenomenology, consequences, intervention practices.** Barbry, F. (Los Alamos National Lab., NM (USA); CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). 1983. Contract W-7405-ENG-36. Translation source information not available . 15p. NTIS, PC A02/MF A01. Order Number DE84002625.

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A consistent program of studies of criticality accidents in enriched uranium solutions was conducted and allowed a great number of instructions to be used on the understanding of the phenomena. The various effects can be better quantified in the future in light of the results acquired. While it appeared that an accidental situation will not result in catastrophic consequences, it is necessary to not underestimate the significance of the risk, its consequences, the impact which it would have on the public and the effort accomplished should allow us to more precisely define the principles and rules of a realistic policy of prevention and intervention in the matter.

25 ENERGY STORAGE

2502 Compressed Gas

REFER ALSO TO CITATION(S) 5980

2503 Pumped Hydro

5980 **Geotechnology in Massachusetts.** Farquhar, O.C. (ed.). Amherst, MA; Univ. of Massachusetts (1982). 626p. (CONF-8003192—).

From Conference on geotechnology in Massachusetts; Boston, MA, USA (20 Mar 1980).

A volume containing papers presented at a conference on geotechnology in Massachusetts is presented. The papers deal with: 1)bedrock geology; 2)surficial geology; 3)hydrogeology; 4)geophysics; 5)soil engineering and rock mechanics; 6)underground space; 7)energy and the geosciences; 8)industrial rocks; 9)mineral resources; 10)enviromnental and geochemical problems; 11)tectonics; 12)nearshore zones; and 13)the marine boundry. Fourteen of the papers have been abstracted for the U.S. Department of Energy Technical Information Center's Energy Data Base. The majority of these papers deal with underground energy storage. Other subjects include petroleum storage in salt caverns, geologic aspects of nuclear power plant siting, peat, and coal deposits. (JMT)

2506 Thermal

5981 **(CONF-831205—4) Field test and assessment of thermal energy storage for residential heating.** Hersh, H. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01. Order Number DE84003989.

From 6. Miami international conference on alternative energy sources; Miami Beach, FL, USA (12 Dec 1983).

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In a field test of thermal energy storage (TES) carried out over two heating seasons in New England, 45 residences were electrically heated during off-peak hours by TES systems and 30 control residences were heated at any time by electric baseboard heaters. The TES users were billed under applicable time-of-day rates. All sites were instrumented and electrical and thermal measurements made and recorded every 15 minutes. Analysis has led to the following findings: (1) overall technical performance of the TES units was good; (2) the seasonal efficiency of electricity utilization was the same for TES and control sites; (3) at both TES and control sites, wide variations in energy consumption occurred on days having the same number of heating degree-days; (4) TES users were satisfied with performance; (5) barriers to rapid commercialization include high capital cost, competition from other electrical heating systems (non-storage) and insufficient utility investment to encourage TES; (6) the development of retrofit storage units that can be coupled to the central hydronic distribution systems in existing fuel-heated houses would greatly increase the size of the potential TES market and directly reduce premium fuel consumption.

5982 **(ORNL/TM—8963) Chemical reactions possibly useful for low temperature thermal energy storage.** Johnson, J.S. Jr.; Westmoreland, C.G. (Oak Ridge National Lab., TN (USA)). Nov 1983. Contract W-7405-ENG-26. 25p. NTIS, PC A02/MF A01. Order Number DE84004126.

Several systems were evaluated for possible enhanced storage of heat in the temperature range from ambient to about 60°C. Included were solutions of a hydrolyzable inorganic ion, polymers with hydrophilic and hydrophobic constituents, organic compounds melting in the range, and fluorinated organics. Of these, inorganic hydrolysis seems definitely not useful. Although no specific embodiments of particular interest were identified in the other classes, further investigation of them may be worthwhile.

2508 Chemical

REFER ALSO TO CITATION(S) 5982

2509 Batteries

REFER ALSO TO CITATION(S) 5846, 6313

5983 **(AD-A—131330/3) Evaluation of low melting halide systems for battery applications. Final report, September 1978-February 1983.** Mamantov, G.; Petrovic, C. (Tennessee Univ., Knoxville (USA). Dept. of Chemistry). Apr 1983. 169p. NTIS, PC A08/MF A01.

This program involved evaluation of selected low temperature molten salt solvent systems containing inorganic and/or organic chlorides and bromides for battery applications. The research involved determination of the liquids temperatures, the specific electrical conductivity, and the electrochemical span of selected halide systems. The studies of a few cathode and anode systems and of two prototype cells were also undertaken for a few promising solvent systems.

5984 **(CONF-831086—9) Structure and electrochemical properties of lead dioxides: a review.** Varma, R. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 16p. NTIS, PC A02/MF A01. Order Number DE84003998.

From Electrochemical Society fall meeting; Washington, DC, USA (9 Oct 1983).

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Recent work on the structure and composition of lead dioxide indicates that the material from lead-acid battery plates contain hydrogen and is nonstoichiometric. The relationship of crystal defects to the electrochemical properties of lead dioxide is discussed. The cycling performance of the lead dioxide electrode is limited in several respects, including structural degradation, loss of conductivity, and decrease in surface area of the PbO_2 material.

5985 **(LBL—16522) Study of model zinc electrode pores in alkaline electrolyte.** Flatt, J.H.; McLarnon, F.R.; Cairns, E.J. (Lawrence Berkeley Lab., CA (USA)). May 1983. Contract AC03-76SF00098. 25p. (CONF-830508—27). NTIS, PC A02/MF A01. Order Number DE84004961.

From 163. Electrochemical Society meeting; San Francisco, CA, USA (8 May 1983).

The objective of this research is to obtain information on the behavior of zinc-electrode pores and evaluate potential failure modes of the rechargeable alkaline zinc electrode. The failure modes include zinc redistribution, densification, passivation and dendrite shorting. This communication will focus on the development of a model zinc electrode pore and a discussion of results from preliminary experimentation.

5986 **(N—8326253) Test results of a ten cell bipolar nickel-hydrogen battery.** Cataldo, R.L. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1983. 11p. (CONF-830812—60; NASA-TM—83384; E—1657). NTIS, PC A02/MF A01.

From 18. intersociety energy conversion engineering conference; Orlando, FL, USA (21 Aug 1983).

A ten cell bipolar nickel hydrogen 6.5 ampere-hour battery demonstrated over 2000 low Earth orbit cycles at an 80 percent depth-of-discharge. Charge/discharge cyclic ampere-hour and watt-hour efficiencies of 88 and 76 percent, respectively, observed. Peak power capability was determined at 1.1 kW. A 10C discharge rate yields 83 percent of the nominal stark capacity to the 1.0 volt cut off in just under 6 minutes.

5987 **(NYSERDA—83-7) Technical and economic analysis of a rapid transit battery storage substation project. Final report.** Robinson, F.; Prouty, T.P.; Squires, R.B. (AiResearch Mfg. Co., Torrance, CA (USA); Gibbs and Hill, Inc., New York (USA)). Apr 1983. 204p. NTIS, PC A10/MF A01. Order Number DE84004833.

This final report evaluates the technical and economic viability of deploying battery storage in New York City subway traction substations. Rapid transit systems, which experience daily peak periods of travel, accommodate the demands by operating numerous multi-car trains at closely spaced intervals. This activity results in two daily peaks in the demand for electric power that the transit system imposes upon the supplying electric utility. Reductions in the magnitude of this peak electric power required from the supplying utility can be accomplished by the storage of electric energy and the transit system side of the electric utility/transit interface. To be viable economically, the dollar worth of the demand reduction must be sufficiently large to offset the battery storage system initial capital outlay and recurring operating and maintenance costs. The method used to evaluate the merit of deploying battery storage in the transit system was to establish a dollar value for the reduced demand, postulate a system to accomplish these savings, and substract the life-cycle cost of this system from the savings on the basis of a net present value. This technique was implemented and the results evaluated for different amounts of battery deployment. Battery storage was found to be both technically feasible and economically attractive. It was concluded that the results of the study warranted construction of the pilot plant described in detail in the report.

29 ENERGY PLANNING AND POLICY

REFER ALSO TO CITATION(S) 5751, 6049, 6050

5988 **(GAO/AFMD—83-92) Department of Energy contracts with the Decision Planning Corporation.** Campbell, W.D. (General Accounting Office, Washington, DC (USA). Accounting and Financial Management Div.). 6 Sep 1983. 8p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

GAO reviewed certain aspects of the Department of Energy's (DOE's) Chicago operations office contracts with the Decision Planning Corporation (DPC). Specifically, the method used by DPC to compute overhead charged to the Government was audited. Also reviewed were: the history of these contracts including an analysis of award methods; the effectiveness of DOE's contract monitoring particularly with respect to the payment of contractor vouchers; and the propriety of contracting for this work rather than having it done by full-time DOE personnel. Findings and recommendations are given. (PSB)

5989 **(GAO/RCED—83-199) Delays in EPA's regulation of hazardous air pollutants.** Bowsher, C.A. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 26 Aug 1983. 64p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760 $3.25.

The Clean Air Act of 1970 requires the Environmental Protection Agency (EPA) to develop a listing of hazardous air pollutants. Once a polluting substance is listed, EPA has to propose standards to regulate the emission of the substance. Since passage of the act, EPA has listed only seven substances as hazardous air pollutants and established emission standards for four of them. Between 1977 and 1982, EPA identified 37 additional substances as candidates for the hazardous substances listing. However, none of these substances have been approved for inclusion on the listing and emission standards have not been proposed. GAO found that various policy shifts at EPA and uncertainty over the type and amount of scientific data needed to support a regulatory action are major contributing factors to delays in developing the hazardous substance listing. Delays also occurred in proposing emission standards after pollutants were listed because of the time required to develop technical and cost information and analyze public comments.

5990 **(GAO/RCED—83-234) Procurement practices in DOE's Office of the Assistant Secretary for conservation and renewable energy.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 15 Sep 1983. 29p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

Delays have been occurring in processing procurement requests for building energy conservation research and development projects and activities in the Department of Energy's Office of the Assistant Secretary for Conservation and Renewable Energy. This report addresses concerns over these delays and specifically discusses the Assistant Secretary's financial planning for fiscal year 1983; Assistant Secretary's approval of these procurement requests; delegation of procurement responsibility; disposition of any funds remaining at the end of the fiscal year; and causes and effects of delays in approving procurement requests.

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 6004, 6010, 6027

5991 **(BNL—51604) Study of baseline energy requirements of the pulp and paper industry in the Bonneville Power Administration service area from 1980 to 2000. Final report.** Pierce, B.L.; Balzer, C. (Brookhaven National Lab., Upton, NY (USA)). Sep 1982. Contract AC02-76CH00016. 31p. NTIS, PC A03/MF A01. Order Number DE84003879.

Brookhaven National Laboratory's process model of the pulp and paper industry is used to examine electricity demand and energy use in the Pacific Northwest over a 25 year period. Results

show electricity demand growth of 1.7% per year in an unconstrained base case and from 1.2% to 2.1% per year in other scenarios. Coal use increases in most scenarios, and oil is phased out in all but one case. No new gas boilers are purchased, and existing boilers are used to capacity in most scenarios. Gas turbines are not purchased when cogeneration is constrained.

5992 **(DOE/CS/10346—T1) International solar commercialization study of the market potential of solar products in Latin America: Jamaica. Final report.** (Solar America, Inc., Albuquerque, NM). Dec 1981. Contract AC01-80CS10346. 105p. NTIS, PC A06/MF A01. Order Number DE84004969.

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The current and forecasted economic situations in Jamaica are reviewed. The logistics of doing business is reviewed, including finance, labor, investment and import policy. Market penetration strategy is presented, with emphasis on the Kingston free zone analysis. A Market Potential for US Renewable Energy Products in Jamaica included government, agricultural, tourism, manufacturing, and mining sectors. Conclusions and recommendations are given. The market readiness of the following renewable technologies was analyzed: photovoltaics; industrial process heat; active and passive solar; biomass; wind; small-scale hydro; ocean thermal; geothermal; and conservation. When appropriate, the foreign competition was also analyzed.

5993 **(DOE/EIA—0321/2(81)-Pt.2) Residential energy consumption survey: consumption and expenditures, April 1981-March 1982. Part 2: regional data.** Egan, B. (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). Nov 1983. 288p. NTIS, PC A13/MF A01 - GPO. Order Number DE84003224.

This is the third report on the 1981 Residential Energy Consumption Survey, which covers the period April 1981 through March 1982. It contains regional data on residential energy consumption and expenditures in the United States. This report contains data for the four Census regions and the nine Census divisions. Total and average consumption and expenditures of total and specific fuels are classified by significant energy-related characteristics of the households and weather zones.

5994 **(EUR—8635-EN) Candidate technologies to relieve the European energy system: France. Final report.** Kracht, G. (CEA, 75 - Paris (France). Dept. des Programmes). 1983. 58p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84900368.

Primary energy costs are calculated at constant prices from the reference data of June 1980. Oil prices are assumed to increase by 3.5% a year between 1980 and 2000 and by 1% a year between 2000 and 2020. It is thus assumed that by the year 2000 low oil-consuming technologies will be developed and substitute energies will be available that can compete with oil or replace it in the event of an interruption in supplies. This hypothetical oil price increase of 3.5% a year is no longer the case at present: the industrialized countries having reduced their consumption, OPEC is endeavouring to maintain prices by reducing production. Since the economies of the developing countries are in fact linked to those of the developed countries, there is no increase in the oil consumption of the poorer countries. It nevertheless appears desirable to maintain the increase in the price of oil at 3.5%, in order to forestall further oil crises. Beyond the year 2000, the 1% rate of increase can point to a recovery, in particular of the nuclear programmes.

5995 **(Juel-Spez—192) Interdependences between the electric power industry and economy.** Hildebrandt, T. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Programmgruppe Systemforschung und Technologische Entwicklung; Koeln Univ. (Germany, F.R.)). Dec 1982. 280p. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number DE84750341.

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After a review of the interdependences between the electric power industry and economy as a whole, theoretical fundamentals are established for disaggregated production models. The concept of the disaggregated simulation model is described as well as its theoretical fundamentals and explanation approaches. Details are given in a further chapter. In the final part of the report, results of exemplary applications of the model system are documented and commented on.

5996 **(NP—4900400) Texas National Energy Modeling Project: purpose, organization and work plan. A planning guide.** Holloway, M.L. (Texas Governor's Energy Advisory Council, Austin (USA)). 23 Jun 1978. 24p. NTIS, PC A02/MF A01. Order Number DE84900400.

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The primary intent of this study effort is to provide an independent, critical evaluation of the PIES model. The study will examine the data reliability, the assumptions, the structure relative to accepted theory and the actual behavior of the model. Our results will be useful as recommendations to the Department of Energy for improving the model, as well as precautions to users concerning its proper use. Finally, the study will produce specific recommendations to the State of Texas for maintaining a national modeling capability.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 5748, 5750, 5759, 6030, 6607

5997 **(TENRAC/EDF—085-Vol.2A) Onshore impacts of offshore oil and gas activities: coastal impact assessment. Final report.** (Rice Center, Houston, TX (USA)). Feb 1983. 227p. NTIS, PC A11;MF A01; 1. Order Number DE84900424.

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This report presents the results of a study carried out to determine the existence of and examine the nature of economic impacts on Texas communities from oil and gas development activities in the Texas offshore area. The analysis included comparisons of several coastal communities, and a comparison of the coastal communities with an inland community. Each of the areas was looked at over time, including forecasts to 1990. Two major types of impacts related to onshore support of offshore oil and gas activities were identified. These impacts were related to water supply needs within coastal communities, and to the coastal communities' ability to finance general capital improvements. The need for increased water supply capacities was one of the most significant impacts identified. The demand for increased capacity was generated from three sources: (1) increased demand as a result of projected baseline growth (using 1982 Texas Department of Water Resources population projections); (2) increased demand from offshore related population growth within the study communities; and (3) increased demand from offshore support bases for water to be used in drilling processes. All of the communities were projected to encounter difficulties in financing these improvements. In addition, the fact that different agencies supply water to some of the individual communities complicates the process of increasing supply capacity. Several of the communities were projected to experience difficulties in securing long term financing to fund general capital improvements. The exact issue which limited the ability to use long term financing was different in each community. The issues ranged from charter limitations to inadequate revenue streams to excessive debt burdens. 4 figures, 160 tables.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 5758, 6007, 6606

5998 **(USGS-OFR—82-233) Earthquake hazards information dissemination: a study of Charleston, South Carolina.** Greene, M.R.; Gori, P.L. (Battelle Human Affairs Research Center, Seattle, WA (USA); Geological Survey, Reston, VA (USA)). 1982. 61p. USGS Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225.

The study identifies how officials and representatives of the private sector in Charleston, South Carolina, learn about earth-

quake hazards and how mitigation and response information gets incorporated in their job functions. The report documents why the officials in the Charleston area think they might need hazards information, what their job responsibilities are, and how they currently obtain information. 59 references. (ACR)

5999 **Global energy and CO_2 to the year 2050.** Edmonds, J.; Reilly, J. (Oak Ridge Associated Universities, Washington, DC). *Energy Journal;* 4: No. 3, 21-47(Jul 1983). Contract AC05-76OR00033.

Carbon dioxide, a product of fossil-fuel combination, has been increasing in the earth's atmosphere and creating a green house effect which has the potential to significantly alter the global climate picture in the next century. This article examines the likely rate of CO_2 increases and their relationship to patterns of energy use via a long-term model and subsequent analysis results. The modeling evaluations conclude that the CO_2 doubling rate will be pushed back much later than originally anticipated; CO_2 tax policies are unlikey to have much effect on further delaying the doubling period; and a reduced global gross national product (GNP) growth or an energy evolution toward non-fossil-fueled technologies will be the only means for shifting the trend. 14 references, 5 figures, 10 tables.

2904 Natural Resources

REFER ALSO TO CITATION(S) 5723, 6024

6000 **(GAO/NSIAD—83-41) Uncertainties surround future of US ocean mining.** Bowsher, C.A. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 6 Sep 1983. 64p. US GAO, PO Box 6015, Gaithersburg, MD 20760.

Report to The Congress.

Federal Government, private sector, and foreign competitor involvement in ocean mining are reviewed to determine if there is a need to develop US ocean mining policy. Uncertainties stem from the absence of (1) a clear legal basis to assure direct access to deep seabed minerals; (2) an assessment that evaluates US vulnerability to supply interruptions of existing mineral markets; and (3) a policy decision of what the Federal role, if any, should be in promoting ocean mining. GAO recommended assessments of US strategic and critical mineral needs and the costs and benefits of alternative approaches to reducing US vulnerability to mineral source of supply disruptions.

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 6029, 6122

6001 **(INIS-mf—8593) Institute for Energy Technology, annual Report 1981.** (Institute for Energy Technology, Kjeller (Norway)). Mar 1982. 36p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704637.

The annual report gives a brief account of the activities of Institute for Energy Technology and presents a fairly comprehensive analysis of the budgetary dispositions in 1981 and, for comparison, 1980.

6002 **Research for energy.** Garbers, C.F. (Council for Scientific and Industrial Research, Pretoria (South Africa)). pp 96-100 of South African energy in perspective: Proceedings Pt. 1. A conference organised by SANCWEC at CSIR Conference Centre, Pretoria, 24-25 Jan 1983. Cape Town, South Africa; South African National Committee (1983). (CONF-830150—Pt.1).

From Conference on South African energy in perspective; Pretoria, South Africa (24 Jan 1983).

This paper deals with energy R D and its funding in the South African public sector. The objectives of the National Programme for Energy Research are discussed within the framework of the country's manpower and financial needs and limitations. It is shown that energy research is multidisciplinary where the focus is on infrastructure development within the constraints of technical, economic and environmental factors. Possible mechanisms to cater for the country's energy research funding are suggested.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 5929, 5930, 5931, 5932, 5963, 5968, 5977

6003 **(CONF-831047—109) Public acceptance of nuclear electric generation sited in energy centers.** Bauman, H.F.; Williams, J.T. (Oak Ridge National Lab., TN (USA); Utah Energy Office, Salt Lake City (USA)). 1983. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE84003273.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

What will make an acceptable future for nuclear power. We believe there are four elements: the power must be needed. The plants must be safe. The power must be economical. The disposal of nuclear waste must be assured. And, above all, the public must believe all four are true. We have completed a study in the State of Utah, with DOE support, of building a number of nuclear power plants at one location-the Nuclear Energy Center (NEC) concept. The project would deliver power to the Southwest region over the first half of the next century; in this time frame we believe the power will be needed. The NEC would consist of nine large units of 1250 MWe each arranged in widely-spaced clusters of three on a large site. A 50 sq. mile site on the Green River was chosen, about 15 miles south of the town of Green River, Utah. About 82% of the power would be distributed outside Utah; the largest load would be the Los Angeles area.

6004 **(DOE/EIA—0438) Commercial nuclear power: prospects for the United States and the world.** Gielecki, M.; Diedrich, R.; Hewlett, J.; Cross, C. (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Nov 1983. 96p. NTIS, PC A05/MF A01 - GPO. Order Number DE84003846.

This report is organized into two major sections: (1) the US commercial nuclear power section consists of a discussion of the status of nuclear power as of the end of 1982, projections of nuclear capacity at 5-year intervals from 1985 through 2020, and a discussion of current issues which affect nuclear power; the nuclear capacity projections are discussed in terms of the near term, the intermediate term, and the long term with low-, mid-, and high-case scenarios. The methodology used consists of a reactor-by-reactor review of nuclear units both operating and under construction. This reactor pipeline analysis assesses the current status of each individual reactor project and its progress toward completion. These intermediate-term projections of nuclear capacity through 2000 serve as a point of departure for the long-term projections through 2020, prepared using the World Integrated Nuclear Evaluation System (WINES). WINES is an aggregated energy demand model that derives nuclear generation requirements as a share of electrical generation; and (2) the foreign commercial nuclear power section consists of a general discussion of the current status of nuclear power in the WOCA countries; low-, mid-, and high-case scenario nuclear capacity projections for individual WOCA countries for 1985, 1990, 1995, and 2000; and, a review of each country's commercial nuclear power program. Nuclear capacity projections through 1990 were developed using a reactor construction pipeline analysis approach. The 1995 and 2000 projections were prepared using the WINES model, which is described in detail in Appendix B.

6005 **(DOE/EP/12086—T3) Regulatory gaps, conflicts, and overlaps in the regulation of environmental releases from nuclear facilities. Task Assignment 6. Final report.** Zimmerman, L.L.; McCloskey, M.H. (Radian Corp., Austin, TX (USA)). Dec 1983. Contract AC01-82EP12086. 117p. NTIS, PC A06/MF A01. Order Number DE84004985.

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Regulation of the nuclear fuel cycle is a highly balkanized process, divided primarily among the Nuclear Regulatory Commis-

sion, the Department of Energy (DOE), the Environmental Protection Agency (EPA), and the Department of Transportation (DOT). The nuclear fuel cycle for a typical light-water reactor consists of five discrete stages: (1) material mining and milling; (2) fuel conversion, enrichment, and fabrication; (3) power production; (4) spent fuel reprocessing; and (5) radioactive waste disposal. The major federal acts regulating facilities in the nuclear fuel cycle include: (1) the Atomic Energy Act of 1954 (AEA), as amended; (2) the Uranium Mill Tailings Radiation Control Act of 1978; (3) the Low-Level Radioactive Waste Policy Act of 1980; (4) the Nuclear Waste Policy Act of 1982; and (5) the Hazardous Materials Transportation Act of 1974. Because two or more federal agencies play a role in almost every stage of the cycle, there is considerable potential for regulatory overlaps and conflicts in the regulation of routine (federally permitted) releases from nuclear facilities. Surprisingly, there are also gaps in the regulatory process. These gaps, overlaps, and conflicts are discussed.

6006 **(GAO/RCED—83-226) Comments on a plan for obtaining private financing for the Clinch River Breeder Reactor.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 22 Aug 1983. 7p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

This review compares the latest CRBR financing plan, released to the Congress on August 1, 1983, with the private financing framework established by Department of Energy and Breeder Reactor Corporation task force reports in March 1983. We discussed these documents and our interpretation of the documents with DOE officials and members of the BRC task force. We also discussed them with representatives of one of the investment banking firms that participated in formulating the plan. We did not solicit DOE's review and comments on a draft of this report because of the short time frame involved in conducting our work. This is also in keeping with the agreement reached regarding agency comments on our May 12, 1983, report. We have discussed the report's contents with managers of the project in an effort to include DOE's views and ensure the report's accuracy.

6007 **(INIS-BR—60) Protection and the preservation of the environment the Brazilian nuclear law.** Faria, N.M. de; Goes Fischer, M.D. de; Rocha, L.M.G. da. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro). 1981. 11p. (In Portuguese). (CONF-8107118—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703965.

From 3. Brazilian ecology symposium; Belo Horizonte, Brazil (1 Jul 1981).

A set of Brazilian rules governing the protection and the preservation of the environment in relation to nuclear activities is presented. The role of CNEN, as an institution that defends the environment is also mentioned.

6008 **Is self-regulation possible.** Barkenbus, J.N. (Inst. for Energy Analysis, Oak Ridge Associated Universities, TN). *Journal of Policy Analysis and Management;* 2: No. 4, 576-588(Sum 1983).

The Nuclear Regulatory Commission's increasingly prescriptive regulation of the nuclear industry can have deleterious effects, perhaps the most serious being the shift in responsibility for safety from the utility to the NRC. Several factors account for this type of regulation including the nature and structure of the nuclear industry, public opinion and bureaucratic incentives, and the nature of the technology itself. The opportunities to create heightened industry self-regulation (performance-based regulation) deserve further examination. The key to self-regulation is to structure incentives so that it is clearly within the nuclear utilities' interests to build and operate nuclear power facilities in the safest manner possible. 27 references.

6009 **Prospects for nuclear power.** De Villiers, J.W.L. (Atomic Energy Corp. of South Africa (Pty) Ltd., Pretoria). pp 18-26 of South African energy in perspective: Proceedings Pt. 1. A conference organised by SANCWEC at CSIR Conference Centre, Pretoria, 24-25 Jan 1983. Cape Town, South Africa; South African National Committee (1983). (CONF-830150—Pt.1).

From Conference on South African energy in perspective; Pretoria, South Africa (24 Jan 1983).

This paper discusses the present and potential nuclear power station capacity in the world and the type of reactor which would be used. The role of the breeder reactor is discussed especially as it affects the usage of uranium. The nuclear power prospects for South Africa are considered. The world uranium requirements are described relative to the forecast of nuclear power and the potential production capacity is discussed. In particular, South Africa's role in the uranium market is described. The paper considers the nuclear fuel cycle, safety aspects of waste storage, and the need for keeping the public informed.

2907 Transport And Storage

REFER ALSO TO CITATION(S) 6081

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 6113

2910 Conservation

REFER ALSO TO CITATION(S) 5878, 6066, 6074, 6079, 6080, 6096, 6098

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 6004, 6025, 6026, 6085, 6088, 6095, 6099

6010 **(DOE/EIA—0430) Intermediate future forecasting system. Executive summary.** Shaw, S.H.; Murphy, F.H. (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). Oct 1983. 37p. NTIS, PC A03/MF A01 - GPO. Order Number DE84003276.

The Intermediate Future Forecasting System (IFFS) was developed to provide year-by-year projections of energy markets. IFFS is a computerized analytical model that is used to represent the current state and the likely trends of the energy system. By representing not only the total demand level for energy but also the inter-fuel competition between the various sources of energy, the model formulates a comprehensive and internally consistent analysis under a particular set of input assumptions. The model's objectives, capabilities, and structure are detailed.

6011 **(Juel-Spez—193) EFOM 12 C case studies. Candidate technologies to relieve the European energy system - Germany.** Hoepfinger, E.; Huber, W. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Programmgruppe Systemforschung und Technologische Entwicklung). Jan 1983. 172p. Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe (Germany, F.R.).

The objective of this study is to acquire an understanding of the potential for introduction into the market and market penetration of the New Technologies for supplying energy and the concomitant implications for the power-producing industry, taking as a basis various restrictions for energy import costs. After a consideration of the significant exogenous assumptions dealt with in the model, as well as a description of the New Technologies included in the model (coal refining technologies, new technologies for electricity generation, new techniques in the household sector, e.g. heat pumps), the present report describes the results of the reference case in which the overall costs of the energy system are minimized. Subsequently, the modifications in comparison with the reference case are elucidated for further strategy runs in which the energy import costs are minimized. The significant difference here is to be seen in the increased utilization both of the capital-intensive New Technologie as well as of nuclear energy. In addition to determining the order of priority for introducing the New Technologies into the market, the implications of a nuclear energy moratorium are investigated in a concluding chapter since all calculations with the

aim of reducing energy import costs lead to a growth of electricity generation by nuclear power.

6012 **(N—8326260) Residential demand for energy: A review of the empirical literature and some new results.** Kirby, S.N. (RAND Corp., Santa Monica, CA (USA)). Jan 1983. 59p. (P—6847). NTIS, PC A04/MF A01.

Demand for energy is derived from the demand for particular end-use service (e.g., warmth, cooling, clothes drying, etc.). This derivative nature of energy demand gives rise to two major, although interrelated, issues: first, a complete model must consider both the demand for services and the demand for energy-using equipment second, the essentially dynamic nature of the demand requires a clear delineation between short-run and long-run responses. Because of their durability, appliance stocks will be adjusted only over a period of time. In contrast, the intensity of utilization of a given appliance portfolio can be adjusted fairly rapidly. In the short run, defined as the period of time during which appliance stocks are fixed, households are essentially limited in their ability to respond to changes in fuel prices and income. In the long run, households may alter their stock of energy using equipment to reflect more accurately their desired capital stock. As such, longer run responses will be much larger in magnitude than short run responses.

6013 **(NP—4770061) Cuba - energy situation 1981.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jan 1983. 10p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770061.

The energy situation of Cuba is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Information is given on external trade and the balance of payment.

6014 **(NP—4770062) Angola - energy situation 1981.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Nov 1982. 12p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770062.

Giving some salient data, a brief review is given on the country's energy situation. A few remarks on its energy policy are followed by a description of developments taking place with regard to individual energy sources and power generation. Furthermore, some important figures on foreign trade are given.

6015 **(NP—4770063) Peoples Republic of Kongo - energy situation 1981.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Oct 1982. 15p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770063.

Using some significant figures, a brief review is given on the country's energy situation. A few remarks on its energy policy are followed by a description of developments taking place as regards individual energy sources and electricity generation. Furthermore, some important figures on foreign trade are given.

6016 **(NP—4770064) Columbia - energy situation 1981.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Nov 1982. 16p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770064.

Giving some salient data, a brief review is given on the country's energy situation. A few remarks on its energy policy are followed by a description of developments taking place with regard to individual energy sources and power generation. Furthermore, some important figures on foreign trade are given.

6017 **(NP—4770066) Togo - energy situation 1981.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Oct 1982. 20p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770066.

Giving a few significant figures, a brief review is given on the country's energy situation. A few remarks on its energy policy are followed by a description of developments taking place with regard to individual energy sources and power generation. Furthermore, a few important figures on foreign trade are given.

6018 **(NP—4770067) Tunesia - energy situation 1981.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Oct 1982. 13p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770067.

A brief account is given on Tunesia's energy situation, focussing on the production of petroleum and natural gas.

6019 **(PB—83-249045) Global energy prospects. Working paper.** Choe, B.J.; Lambertini, A.; Pollak, P. (International Bank for Reconstruction and Development, Washington, DC (USA)). [nd]. 76p. (WP—489). NTIS.

This paper presents the assumptions and discusses some of the key issues that underlie the energy projections contained in the World Development Report 1981. It examines the adjustments which have taken place since the oil price increase in 1973/74 in the use of energy in five major country groups. Based on these trends in energy conservation and increased energy efficiency, the paper provides energy projections by major fuels for these country groupings for the 1980s. It also examines the supply prospects of the four major fuels--petroleum, natural gas, coal, and primary electricity--and those of synthetic fuels.

6020 **World energy prospects.** Ruttley, E. (World Energy Conference, London (UK)). pp 5-16 of South African energy in perspective: Proceedings Pt. 2. A conference organised by SANCWEC at CSIR Conference Centre, Pretoria, 24-25 Jan 1983. Cape Town, South Africa; South African National Committee (1983). (CONF-830150—Pt.2).

From Conference on South African energy in perspective; Pretoria, South Africa (24 Jan 1983).

The purpose of this paper is to show that the real basis for energy projection has changed by little and that we should not be deluded by the present apparent glut of certain primary energy resources, nor by excess electricity generation into believing that the fundamentals of the energy problem have changed. Not the energy problem, but the economics have changed. Various aspects of energy, including energy demand, energy conversion, energy consumption, energy policy, as well as different sources of energy are discussed. The question is asked whether these resources would be able to supply in the energy demand.

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 5736, 5753, 6000, 6006, 6007, 6013, 6014, 6016, 6017

6021 **(NP—4900401) Testimony before the House Ways and Means Committee concerning the exemption of residential utility sales from the sales tax.** Holloway, M.L. (Texas Governor's Energy Advisory Council, Austin (USA)). 3 Feb 1977. 11p. NTIS, PC A02/MF A01. Order Number DE84900401.

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The proposed policy position paper addresses twenty-three issues in four major areas of energy policy including (1) demand policy, (2) supply policy, (3) transportation policy and (4) tax structure changes. Remarks focus on the expected reduction in energy costs to residential consumers from removal of the 4% sales tax on gas and electric utility sales; the geographical distribution of the current tax load; possible savings from a combination of tax changes; and consideration of other alternatives.

6022 **(NP—4900403) Analysis of selected natural gas occupation tax alternatives in Texas.** Sawey, R.; Helgren, K.; Cumming, G.; Holloway, M.L. (Texas Governor's Energy Advisory Council, Austin (USA)). 19 Jul 1976. 12p. NTIS, PC A02/MF A01. Order Number DE84900403.

It is very important to note that all of the numbers given here are representative of Texas during time periods different than those analyzed, only if the price distribution of the natural gas and the quantities of interstate and intrastate gas for October, 1975 and projected 1985 values are appropriate. Care should be taken in generalizing the results to other time periods. A substantial change in either the price distribution or the quantities of gas going out-of-state compared to those remaining in-state could greatly effect the

results under any of the proposals. The general conclusions to be drawn from the analysis, however, remain unchanged. A change in the natural gas tax structure along the lines of Alternatives 2 to 5 can make a significant short-term impact on the interstate-intrastate tax load and current inequity of taxes paid per MCF of gas. The dollar importance and the equity correction both tend to disappear in the long term, however, except in the flat rate (Alternative 5) case. The flat rate case, however, results in an erosion of the tax base from nautral gas because the tax per MCF does not keep pace with expected rising prices of natural gas. The ideal tax from both an equity and maintenance of tax base viewpoint is a flat rate adjusted periodically to keep pace with price increases in natural gas.

6023 **Energy policy formulation and energy administration in South Africa.** Du Plessis, S.J.P. (Department of Mineral and Energy Affairs, Pretoria (South Africa)). pp 19-23 of South African energy in perspective: Proceedings Pt. 2. A conference organised by SANCWEC at CSIR Conference Centre, Pretoria, 24-25 Jan 1983. Cape Town, South Africa; South African National Committee (1983). (CONF-830150—Pt.2).

From Conference on South African energy in perspective; Pretoria, South Africa (24 Jan 1983).

The evolvement of the governmental energy administrative mechanisms is discussed. Energy policy formulation and the role of the Department of Mineral and Energy Affairs in this regard are outlined. The energy administrative process, with reference to various energy carriers and specific spheres of the South African energy economy is discussed. It is indicated that close co-operation between the public and private energy sectors should result in mutual understanding of each others' practical problems and objectives, and should contribute towards the process of judicious energy policy formulation and administration in the interests of the national well-being.

6024 **Proposed fiscal year 1984 budget request. Hearings before the Committee on Energy and Natural Resources, United States Senate, Ninety-Eighth Congress, First Session, February 1, 2, and 3, 1983.** Washington, DC; Government Printing Office (1983). 766p. Government Printing Office, Washington, DC.

Energy Secretary Donald Hodel, Interior Secretary James Watt, Assistant Secretary of Agriculture John Crowell, Jr., and Edward Noble of the US Synthetic Fuels Corporation were the principal witnesses at three days of hearings on the proposed 1984 budget. Committee members expressed concern over the administration's budget cuts (particularly those affecting the Strategic Petroleum Reserve), its plans to sell or lease public land for development, its royalty management, and progress in synthetic-fuels development. The witnesses defended their programs and budget figures. Additional responses submitted for the record follow the statements of each hearing. (DCK)

6025 **US Department of Energy - panning, policies, and future.** Barton, J.L. (US Dept. of Energy, Washington, DC). *ASTM Standardization News;* **10**: No. 4, 20-25(Apr 1982).

The Reagan Administration bases its energy plans on the free-market principle, with the federal government merely setting and enforcing the rules and providing financial assistance in the research areas that have a long-term high payoff and high short-term costs. The ten major points of the Reagan Administration's energy policies are outlined. The present status of American energy resources are summarized and future prospects are projected. 6 figures.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 5736, 5746, 5748, 5749, 5750, 5751, 5753, 5758, 5759, 5999, 6022

6026 **(IEA/EAS—H3/82) Future economics of coal-based energy in the residential market.** Macadam, J.A. (International Energy Agency Coal Research, London (UK). Economic Assessment Service). Feb 1983. 175p. IEA, 14/15 Lower Grosvenor Place, London SW1W 0EX England.

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Space-heating is the main end-use for energy in the residential sector, and for space-heating the dominant fuels are currently oil products and natural gas. Potential coal-based competitors to these are electricity (including electricity from nuclear and hydroelectric plants), SNG, district heating (supplied initially by heat-only boiler plant and later by cogeneration), and the direct use of coal. The report examines which of these secondary energy forms would be the economic choice for particular end-uses, in the likely event that the price of coal becomes a major factor in the cost of each one. It presents the marginal cost of delivered energy from each secondary energy form for particular conditions; but it also suggests cases where social or environmental factors will indicate a choice on non-economic grounds. The report also seeks to clarify the relative importance of the various components of cost, and how they influence the preferred economic routes in different circumstances, for example with different coal costs and with historically different energy distribution systems. Four widely different examples are taken, broadly corresponding to the situations in Sweden, the UK, and two regions of the USA. In each case, an economic model includes appropriate values for the size of demand, the cost of distribution and other influencing factors. From the model are derived economic market shares for a range of coal costs and for real discount rates of 5%, 10% and 15% pa. 185 references, 18 figures, 45 tables.

6027 **(NP—4900333) Comparisons of US domestic petroleum liquids production and US imports, September 1975-March 1976.** Stevens, M. (Texas Governor's Energy Advisory Council, Austin (USA)). 15 Apr 1976. 5p. NTIS, PC A02/MF A01. Order Number DE84900333.

On March 18, 1976, the Associated Press reported that the United States had imported more crude oil than was produced domestically for the first time in history. This statement is correct if one compares domestic production as generally defined as production of crude oil and lease condensate with imports of crude oil and petroleum products. A comparison of total domestic liquids production with total liquids imported may be more appropriate; this comparison shows that imports comprised 46% of the total domestic production plus imports that same week, although this appears to be an unusual week. Weekly import figures vary for a number of reasons. The author of the article stated that the figure production published was probably a typographical error. The total imports given were correct, according to API. Domestic production and crude oil imports are usually reported by the Federal Energy Administration; however, this agency is currently using API's statistics while modernizing their computer systems. The FEA informally confirmed the figures quoted in the newspaper article; later, the agency backed off from that confirmation.

6028 **Oil stockpiling: help thy neighbor.** Hogan, W.W. (Harvard Univ., Cambridge, MA). *Energy Journal;* **4**: No. 3, 49-71(Jul 1983).

An analysis is presented of American oil stockpiling policy whose results reinforce the case for even more vigorous work in this type of energy emergency preparedness. A model is applied that examines the concept of stockpiling under uncertainty as a starting point for an investigation of the role of the interdependence among oil-importing countries. It is concluded that even though stockpiling is an international public good, oil importers should be concerned with making the investment instead of worrying about other nations expecting a free ride.

6029 **Analysis of the benefits of gas technology R and D.** Darrow, K.G. Jr. (Gas Research Inst., Chicago, IL); Nesbitt, D.M.; Marshalla, R.A. *Energy Systems and Policy;* **7**: No. 3, 195-234(1983).

Six alternative scenarios were developed and analyzed to provide insights into the economic benefits of R and D on gaseous fuel supply and utilization technologies. The scenarios explore changes in the rate of new technology introduction under various assumptions regarding the future prices for oil, coal, and electricity. A long-range energy sector simulation model was used to analyze the scenarios. The model requires an extensive technology data

base that was developed for this analysis. 6 references, 9 figures, 12 tables.

2950 Hydrogen And Synthetic Fuels

REFER ALSO TO CITATION(S) 6024

6030 **Synthetic-fuel development: potential socio-economic impacts of single and multiple projects.** Schweitzer, M.; Carnes, S.A.; Soderstrom, E.J.; Braid, R.B. (Oak Ridge National Lab., TN). *Energy Policy;* 11: No. 4, 333-345(Dec 1983).

As a result of the perceived US vulnerability due to dependency on foreign petroleum supply sources, both public and private agencies have sought to speed the development of synthetic fuels. Given the concentration of the necessary natural resources, such development is likely to have significant social consequences. The authors draw upon experience gained in conducting social-impact analyses on six proposed Department of Energy demonstration facilities. Attention is focused on the cumulative impacts anticipated in the region surrounding Newman, Kentucky, site of the Solvent Refined Coal-I project. The authors offer generalizations about community impacts and policy implications, relevant not only to synthetic fuels but also to other high technology energy systems. 26 references, 3 figures, 1 table.

2960 Electric Power

REFER ALSO TO CITATION(S) 5911, 6021, 6718, 6719

6031 **(DOE/EI/11813—T1) Electric power energy information project.** (Systems and Applied Sciences Corp., Riverdale, MD (USA)). 22 Nov 1983. Contract AC01-81EI11813. 30p. NTIS, PC A03/MF A01. Order Number DE84002212.

This document submits Final Task Reports for recently completed task assignments. Most are routine survey operation tools with no tangible deliverables, save continued smooth operations.

6032 **(N—8326256) Advanced cogeneration research study. Survey of cogeneration potential.** Slonski, M.L. (Jet Propulsion Lab., Pasadena, CA (USA)). May 1983. 59p. (NASA-CR—172648; JPL-PUBL—83-40). NTIS, PC A04/MF A01.

Fifty-five facilities that consumed substantial amounts of electricity, natural gas, or fuel oil were surveyed by telephone in 1983. The primary objective of the survey was to estimate the potential electricity that could be generated in the SCE service territory using cogeneration technology. An estimated 3667 MW sub e could potentially be generated using cogenerated technology. Of this total, current technology could provide 2569 MW sub p and advanced technology could provide 1098 MW sub e. Approximately 1611 MW sub t was considered not feasible to produce electricity with either current or advanced cogeneration technology.

6033 **Plans and perspectives: the industry's view.** Moore, T.; Young, F.S.; Feher, S. *EPRI (Electric Power Research Institute) Journal;* 8: No. 8, 14-19(Oct 1983).

An EPRI survey of 66 utilities probes the industry's future for strategic planning guidance and finds continuing support for conservation and advanced generating technologies. 3 figures.

6034 **Paul Joskow: accent on economic efficiency.** Newman, M. *EPRI (Electric Power Research Institute) Journal;* 8: No. 8, 23-28(Oct 1983).

Profile.

A leading specialist in government regulation and member of EPRI's Advisory Council recommends that the industry take advantage of breathing space now to implement reforms that will serve the industry and the country well into the future. Sustained economic growth will require greater productivity, better educated and more highly motivated workers, capital investment, and technological innovation. Joskow foresees a trade-off between deregulation and economic efficiency, and increase in joint ventures and more cautious demand forecasting.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 5991, 5994, 6010, 6032

6035 **(UCID—18991-82) California energy flow in 1982.** Briggs, C.K.; Borg, I.Y. (Lawrence Livermore National Lab., CA (USA)). 26 Oct 1983. Contract W-7405-ENG-48. 20p. NTIS, PC A02/MF A01. Order Number DE84004861.

For the second year California's energy picture reflected the nationwide recession and conservation movement. Total use was down to 6.0 quads from 6.4 quads in 1980 and 6.3 quads in 1981. Preliminary data suggest that California usage fell slightly more than that of the US as a whole on a percentage basis. The largest change in primary supply was in crude oil. Oil imports from foreign and out-of-state sources declined 32% and 17% respectively. Despite take-or-pay contracts with oil suppliers, utilities were successful in lowering oil used for power generation by 66%. Abundant hydropower from a wet 1981-1982 winter augmented electrical supplies. Natural gas use in the state fell slightly. Power from nuclear sources remained well below historical highs due to continuing problems with the state's two licensed reactors. Purchases from small power producers by utilities (cogeneration, solid waste, wind, solar and small scale hydro) continued. Approximately 10% of new capacity in the next decade is anticipated to come from these sources. The largest cogeneration units to come on line in 1982 were in the 40 to 60 MW(e) range. Geothermal development reached 1GW(e) installed capacity.

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 5878, 5908, 5992

6036 **(PB—83-244541) Abstracts of science and technology in Japan: renewable energy, volume 3, number 4.** (Japan Information Center of Science and Technology, Tokyo). 1983. 67p. NTIS $25.00.

The journal provides the abstracts of Japanese literatures concerning the research, development and utilization of renewable energy sources and the related fields. The articles are scanned from recent journals published in Japan.

6037 **Alternative energy options.** Bennett, K.F. (Cape Town Univ. (South Africa). Energy Research Inst.). pp 87-95 of South African energy in perspective: Proceedings Pt. 1. A conference organised by SANCWEC at CSIR Conference Centre, Pretoria, 24-25 Jan 1983. Cape Town, South Africa; South African National Committee (1983). (CONF-830150—Pt.1).

From Conference on South African energy in perspective; Pretoria, South Africa (24 Jan 1983).

It is accepted that coal will continue to play the major role in the supply of energy to the country for the remainder of the century. In this paper, however, emphasis has been directed to those options which could supplement coal in an economic and technically sound manner. The general conclusion is that certain forms of solar energy hold the most promise and it is in this direction that research, development and implementation programmes should be directed. Tidal energy, fusion energy, geothermal energy, hydrogen energy and fuel cells are also discussed as alternative energy options.

6038 **Energy from alcohol: the Brazilian experience.** Rothman, H.; Greenshields, R.; Calle, F.R. Lexington, KY; University Press of Kentucky (1983). 196p.

Brazil's eight-year program to develop an ethanol economy is a political and technological experiment aimed at replacing petroleum with renewable biomass as the major energy source. The authors describe how the program is organized and how it functions, the emerging ethanol chemical industry, the use of ethanol as a fuel, and the economic and environmental issues associated with growing fuel, and the economic and environmental issues associated with growing fuel instead of food. The book concludes with the speculation that other Third World countries can learn from the

mistakes and successes of Brazil's program. 196 references, 19 figures, 32 tables. (DCK)

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

REFER ALSO TO CITATION(S) 6393

6039 **(CONF-820814—48) Seed-slag fouling and corrosion in an MHD steam bottoming plant.** Chow, L.S.H.; Dunn, P.F.; Natesan, K.; Johnson, T.R.; Reed, C.B.; Schlenger, B.J. (Argonne National Lab., IL (USA)). 1982. Contract W-31-109-ENG-38. 12p. NTIS, PC A02/MF A01. Order Number DE84004016.

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

Portions are illegible in microfiche products.

At the Argonne MHD Process Engineering Laboratory (AMPEL), five fouling tests have been carried out to investigate the deposition of seed-ash deposits that form on tubes in the convective sections of the MHD/steam bottoming plant. The effect of these deposits on heat transfer, their tenacity, composition, and effective thermal conductivities were determined. In these tests, combustion gas containing ash particles and K_2SO_4 was passed through a bank of 15 vertical, cooled tubes, which simulated a steam superheater or reheater. In addition to these fouling tests, long duration corrosion tests of commercial-grade metal alloys have been conducted in the laboratory under controlled conditions of gas and metal temperatures, gas chemistry, and deposit compositions. The tests completed to date support the premise that the convective sections of the MHD/steam bottoming plant can be designed to operate efficiently and reliably, and that suitable metal alloys are commercially available. 12 references.

6040 **(DOE/IG—0200) Magnetohydrodynamics (MHD) program administered by the Department of Energy.** (USDOE Office of Inspector General, Washington, DC). 9 Dec 1983. 61p. TIC. Order Number DE84004161.

Report To The Secretary.

The audit was made to determine: (1) whether the magnetohydrodynamics (MHD) program was being carried out in accordance with the purpose authorized by the Congress and within the framework of the current estimated cost and time scheudles; and (2) if the program could be managed to achieve program goals in a more efficient and effective manner. The review was accomplished during the period August 1982 through March 1983 and was made in accordance with generally accepted government auditing standards for program results audits. The scope of review work consisted of: (1) examining the annual budget expenditures, contractor performance, technical progress, safety, subcontracts, and other matters related to the MHD program; (2) reviewing budget requests in order to place the Department's budget initiatives in context with congressional interest in the MHD program, especially the Component Development and Integration Facility (CDIF) and the Coal-Fired Flow Facility, (CFFF); (3) examining internal and external management reports; (4) interviewing responsible program officials; and (5) touring and inspecting the facilities and equipment at each of the above mentioned locations. An exit conference was held on May 17, 1983, with the Assistant Secretary for Fossil Energy relative to the matters discussed in this report. Details are presented. (WHK)

3003 Thermoelectric Generators

REFER ALSO TO CITATION(S) 6248

3005 Fuel Cells

REFER ALSO TO CITATION(S) 5689, 6313, 6393

6041 **(DOE/ET/11304—27) Development of molten carbonate fuel cell technology. Technical progress report, January-March 1983.** (Energy Research Corp., Danbury, CT (USA)). 1983. Contract AC02-76ET11304. 26p. NTIS, PC A03/MF A01. Order Number DE84002938.

Several fabrication methods were evaluated for a cost-effective production of strong, ribbed anodes. Also, a ceramic addition for stabilizing broad pore spectrum cathode structures was investigated and appears promising. Post-test results of out-of-cell anode creep and cathode stability tests as well as laboratory-, and bench-scale cell tests are summarized. Tape-cast anode structures show a linear increase in creep strength with higher $LiAlO_2$ additions. No change in conductivity was noted. The highest addition level has achieved good performance in a laboratory-scale cell. The cell test is continuing. Significant improvement in cathode stability was observed in an out-of-cell test using low level $LiAlO_2$ impregnation in a broad pore spectrum, film-cast plaque. The pore distribution remained essentially unchanged after 1500 hours of testing. This stabilization method is an extension of our method for stabilizing anodes. Further cathode stability testing will be conducted to establish the effect of this approach on long-term cathode stability and cell performances. Post-test analysis of a ceramic stabilized anode which operated for almost one year has shown structural stability similar to what would be expected from out-of-cell tests.

6042 **(FCR—4930) Development of molten carbonate fuel cell power plant technology. Quarterly technical progress report No. 13, October 1, 1982-December 31, 1982.** (United Technologies Corp., South Windsor, CT (USA). Power Systems Div.). Jan 1983. Contract AC02-79ET15440. 26p. NTIS, PC A03/MF A01. Order Number DE84001695.

The overall objective of this program is to develop and verify the design of a prototype molten carbonate fuel cell stack which meets the requirements of a 1990's-competitive coal-fired electrical utility central station or industrial cogeneration power plant.

6043 **(LA—9787-PR) Fuel cells for transportation applications. Progress report, January 1-December 31, 1982.** Huff, J.R. (comp.). (Los Alamos National Lab., NM (USA)). Sep 1983. Contract W-7405-ENG-36. 52p. NTIS, PC A04/MF A01. Order Number DE84003969.

The long-term program goal is to explore and improve the potential of fuel cell systems for use in transportation applications through basic research. A concurrent applied research effort is directed toward bringing fuel cell technology to an established proof-of-concept level. In CY 1982, research investigations included (1) electrode kinetic studies to determine the effects of electrolytes on oxygen reduction at platinum, (2) electrode characterization using ion beam techniques, and (3) determinations of the structure, transport, and stability characteristics of solid polymer electrolytes. In addition, evaluations of electrode and fuel cell performance under simulated vehicle operating conditions were initiated, and fuel cell system simulations to determine vehicle and testing requirements were carried out.

6044 **(N—8326252) NASA redox storage system development project.** (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Apr 1983. 45p. (NASA-TM—83087; E—1546). NTIS, PC A03/MF A05.

The operating temperature was raised from 25 C to 65 C, which enhanced the kinetics of the chromium electrode charging reactions. The design of the auxiliary electrochemical cell, which is used to keep both reactants at the same state of charge, was modified, leading to better and more stable performance. Preliminary

testing has shown that the four tank mode of operation improves energy efficiency as much as 5 percentage points over the conventional two tank mode. Another variation in operating mode, the use of mixed reactants, potentially offers several very attractive advantages. Preliminary reactant cost studies lend further weight to the feasibility of the mixed reactant concept. Electrode studies show that reproducibility of performance is very dependent on the pyrolysis temperature at which the carbon/graphite felt substrate is formed. Membrane development work continued to concentrate on cost reduction and the enhancement of resistivity and selectivity.

6045 **(N—8327351) Evaluation program for secondary spacecraft cells. Cycle life test.** Harkness, J.D. (Naval Weapons Support Center, Crane, IN (USA)). Feb 1982. 298p. (NASA-CR—172679). NTIS, PC A13/MF A01.

Evaluation of secondary spacecraft cells was begun according to the program outline. The cycle life test of the evaluation program of secondary spacecraft cells, through 15 December 1981 is covered.

6046 **(N—8327352) Evaluation program for secondary spacecraft cells. Cycle life test.** Harkness, J.D. (Naval Weapons Support Center, Crane, IN (USA)). 1983. 300p. (NASA-CR—172680). NTIS, PC A13/MF A01.

Evaluation of secondary spacecraft was begun. The cycle life test of the evaluation program of secondary spacecraft cells, through 15 December 1982 is covered.

6047 **(PNL—4001-4) Development of materials for open-cycle MHD. Quarterly report for the period ending June 1983.** Marchant, D.D.; Bates, J.L. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1983. Contract AC06-76RL01830. 19p. NTIS, PC A02/MF A01. Order Number DE84003855.

Pacific Northwest Laboratory (PNL) is conducting an ongoing study of channel components for open-cycle, coal-fired magnetohydrodynamic (MHD) generators. Specifically, electrodes and insulators are being developed. The electrical conductivity has been measured on several compositions based on hafnium oxide, rare earth oxides, and indium oxide and on In_2O_3-SnO_2 compositions. Indium oxide at present appears to be the main constituent required for high conductivity. In the indium oxide-rare earth oxides-hafnium oxide compositions, the indium forms compounds with the other elements and is present in samples as individual grains and not as a contaminant along the grain boundary. In the In_2O_3-SnO_2 compositions, adding SnO_2 to In_2O_3 produces compositions with higher conductivity than pure In_2O_3.

6048 **Corrosion resistant positive electrode for high-temperature, secondary electrochemical cell.** Otto, N.C.; Battles, J.E.; Smaga, J.A.; Warner, B.J. (to US Dept. of Energy). US Patent 4,401,714. 30 Aug 1983. Filed date 7 Jul 1982. vp.

PAT-APPL-395872.

The corrosion rate of low carbon steel within a positive electrode of a high-temperature, secondary electrochemical cell that includes FeS as active material is substantially reduced by incorporating therein finely divided iron powder in stoichiometric excess to the amount required to form FeS in the fully charged electrode. The cell typically includes an alkali metal or alkaline earth metal as negative electrode active material and a molten metal halide salt as electrolyte. The excess iron permits use of inexpensive carbon steel alloys that are substantially free of the costly corrosion resistant elements chromium, nickel and molybdenum while avoiding shorten cell life resulting from high corrosion rates.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

REFER ALSO TO CITATION(S) 5992

6049 **South African energy in perspective: Proceedings Pt. 1. A conference organized by SANCWEC at CSIR Conference Centre, Pretoria, 24-25 Jan 1983.** Cape Town, South Africa; World Energy Conference (1983). 100p. (CONF-830150—Pt.1). Energy Research Institute, c/o University of Cape Town, Private Beg, Roundebosch, 7700, South Africa, at SA R12 / US $12 per set.

From Conference on South African energy in perspective; Pretoria, South Africa (24 Jan 1983).

Indivudual items in scope for the data base are processed separately.

6050 **South African energy in perspective: Proceedings Pt. 2. A conference organized by SANCWEC at CSIR Conference Centre, Pretoria, 24-25 Jan 1983.** Cape Town, South Africa; World Energy Conference (1983). 36p. (CONF-830150—Pt.2). Energy Research Institute, c/o University of Cape Town, Private Beg, Roundebosch, 7700, South Africa, at SA R12 / US $12 per set.

From Conference on South African energy in perspective; Pretoria, South Africa (24 Jan 1983).

Individual items in scope for the data base are processed separately.

3201 Buildings

REFER ALSO TO CITATION(S) 5867, 5868, 5878, 5880, 5881, 5981, 6012, 6108, 6126, 6127, 6390

6051 **(CONF-8206130—) Proceedings of the building thermal mass seminar, 1982.** Courville, G.; Bales, E. (eds.). (Oak Ridge National Lab., TN (USA)). Aug 1983. Contract W-7405-ENG-26. 483p. NTIS, PC A21/MF A01. Order Number DE83016398.

From Building thermal mass seminar; Knoxville, TN, USA (2 Jun 1982).

Portions are illegible in microfiche products. Original copy available until stock is exhausted.

Twelve papers and two abstracts are included. A separate abstract was prepared for each paper and the abstracts were listed by title. Included in appendices are a reprint One-Dimensional Heat Conduction Through Multilayered Slabs and a thermal mass bibliography. (MHR)

6052 (CONF-8206130—, pp 1-10) **Influence of thermal mass on building energy usage.** Childs, K.W. (Oak Ridge National Lab., TN). Aug 1983. NTIS, PC A21/MF A01.

From Building thermal mass seminar; Knoxville, TN, USA (2 Jun 1982).

A qualitative discussion of the influence of thermal mass on building energy usage is presented. The relevant properties of building mass and their influence on building energy usage are discussed. Conditions necessary for any energy savings to result from mass are identified.

6053 (CONF-8206130—, pp 11-24) **Dynamic response of thermal masses and their interactions using vector diagrams.** Subbarao, K. (Solar Energy Research Inst., Golden, CO). Aug 1983. NTIS, PC A21/MF A01.

From Building thermal mass seminar; Knoxville, TN, USA (2 Jun 1982).

A powerful diagrammatic technique is summarized for analyzing the dynamic response of a building as a sum of component responses. Using vector diagrams, we can obtain the amplitude Δ and phase of the diurnal frequency fluctuation of the indoor temperature due to three primary driving functions: outdoor temperature, solar gains, and internal gains. The steady-state conductance L (Btu/hr°F) and the base temperature T/sub B/ can be calculated in the same manner as in the Variable-Base Degree Day method. Cor-

relations have been developed between degree days [equal by definition to auxiliary energy/(L x 24)] and T/sub B/ for various values of Δ. These correlations are dependent on building dynamics; degree days as defined here depend on the dynamic response of the building even after the base temperature is known. Thus, they are different from conventional weather-based degree days. The diagrammatic method together with the correlations provides an intuitive calculational method that highlights the role of different components in determining total building performance.

6054 (CONF-8206130—, pp 25-71) **Closed-loop effects of thermal mass on control system performance.** MacArthur, J.W.; Rasmussen, R.W. (Honeywell Inc., Roseville, MN). Aug 1983. NTIS, PC A21/MF A01.

From Building thermal mass seminar; Knoxville, TN, USA (2 Jun 1982).

Effects of thermal mass on energy consumption, comfort conditions, and control system performance for residential environmental systems are presented for a number of specific applications. The effects of internal mass on temperature response and room temperature swings are investigated. Also presented are results on the placement of insulation relative to thermal mass, the effects of varying the coupling between control systems and their local environment, and the impact of internal surface thermal capacitance on thermostat performance. The dynamic interactions involved in these areas are fairly complex, with actions involved in these areas are fairly complex, with coupling and feedback between building, plant, and controller; thus a realistic prediction of these phenomena requires a detailed closed-loop analysis. A description of one such approach to closed-loop analysis is also presented. Finally, comments are given concerning general guidelines on the use of thermal mass in conjunction with closed-loop control systems.

6055 (CONF-8206130—, pp 73-98) **Thermal inertia response to simple harmonic driving terms.** Arumi-Noe, F. (Univ. of Texas, Austin). Aug 1983. NTIS, PC A21/MF A01.

From Building thermal mass seminar; Knoxville, TN, USA (2 Jun 1982).

Some general properties associated with the thermal inertia of architectural walls are highlighted. These properties are derived from a steady state solution of the heat diffusion equation in response to simple harmonic driving terms. The particular solutions can be adapted to any set of driving terms that can be expanded in a Fourier series, in which case the solutions presented here become the Fourier coefficients of the solution series. The key gauge to measure the magnitude of thermal inertia effects is the heat penetration depth, and its comparative magnitude in relation to the wall thickness. There are two thermal inertia effects: the reduction of the amplitude of the signals; and the time lag in occurrence of the maximum response value. Both of these effects are measured relative to the static results. Floating temperature and heat load calculations are illustrated. The two extreme thermal inertia limits (zero and infinite) are examined and the conditions under which either limit yields reasonable approximations to the finite thermal inertia case are illustrated. In addition to the illustration of general results, the methodology presented here lends itself to simplified manual calculations of loads and temperature oscillations. One example of each is given.

6056 (CONF-8206130—, pp 99-176) **Conduction transfer functions and the heat balance method for thermal simulation of multiroom buildings.** Kusuda, T.; Walton, G.N. (National Bureau of Standards, Washington, DC). Aug 1983. NTIS, PC A21/MF A01.

From Building thermal mass seminar; Knoxville, TN, USA (2 Jun 1982).

Methods for modeling thermal mass are reviewed: finite difference and finite element techniques, recent developments in time domain and frequency domain conduction transfer functions, and a new analytic solution for three dimensional heat transfer in a slab-on-grade configuration. Convective and radiative processes which thermally connect the building masses with the room air and each other are briefly discussed. The equations for single and multiroom energy balances are described. These include new methods for interroom air movement. A set of sample calculations are presented to show the influence of various simulation methods, particularly as they relate to multiroom analysis, on comfort and energy use.

6057 (CONF-8206130—, pp 177) **Analysis of the thermal mass effect of ground using multidimensional response factors.** Cumali, Z.; Davis, P. (CCB/Cumali Associates, Oakland, CA). Aug 1983. NTIS, PC A21/MF A01.

From Building thermal mass seminar; Knoxville, TN, USA (2 Jun 1982).

The problem of determining the heat transfer processes in residences and commercial structures requires accurate analytical models if one is to adequately define energy conservation measures. Various energy analysis computer simulation programs are presently available for use in the public sector. Among these, DOE-2.1a and BLAST represent the state of the art in determining building thermal loads and energy usage quantities. However, these programs do not rigorously deal with the problem of heat transfer in earth contact structures. This situation, although minor when compared with the relatively comprehensive methodology utilized for the overall energy analysis of traditional above grade buildings, nevertheless detracts from the primary goal of a well-defined simulation. For single family residences, below grade or basement heat losses may represent upwards of 20% of the annual heating load. For buildings that have extensive earth contact facets, heat exchange may be dominated by the earth sheltered surfaces. Thus, it is apparent that adequate mathematical models must be developed to properly define such phenomena.

6058 (CONF-8206130—, pp 179-206) **Calculation of the effect of mass on building energy consumption by network methods.** Emery, A.F.; Kippenhan, C.J.; Heerwagen, D.R. (Univ. of Washington, Seattle). Aug 1983. NTIS, PC A21/MF A01.

From Building thermal mass seminar; Knoxville, TN, USA (2 Jun 1982).

The use of the network method for simulating the thermal response of buildings, particularly those with massive walls or walls of high thermal capacitance is described. Recommendations for the choice of the time increments and for the number of nodes and their placement are given. Examples of the use of the network method to predict the beneficial effects of thermal mass, either in absolute terms or in relation to the behaviour of light weight walls are described. It is shown that the advantageous of thermal mass are not always easy to define a-priori and that simulation over lengthly weather periods is necessary to define the thermal response accurately. The examples demonstrate that, when designed correctly, thermal mass may result in substantial reductions in building heating or cooling loads.

6059 (CONF-8206130—, pp 207-224) **Survey of simplified techniques for calculating energy effects of building mass.** Barnaby, C.S. (Berkeley Solar Group, CA). Aug 1983. NTIS, PC A21/MF A01.

From Building thermal mass seminar; Knoxville, TN, USA (2 Jun 1982).

A variety of schemes for estimating the energy effects of thermal mass in buildings are reviewed. Some of the methods are extensions to steady state methods; others are tabulations of data derived from dynamic calculations made on wall elements or rooms; still others were derived analytically. Some general observations about simplified methods and the calculation approaches are discussed. (MHR)

6060 (CONF-8206130—, pp 225-264) **Evaluation of thermal mass effects in buildings using laboratory tests.** Fiorato, A.E. (Portland Cement Association, Skokie, IL). Aug 1983. NTIS, PC A21/MF A01.

From Building thermal mass seminar; Knoxville, TN, USA (2 Jun 1982).

A discussion of the role of laboratory tests in evaluating effects of mass on thermal performance of building envelopes is presented. Laboratory tests are shown to provide a basis for defining thermal and physical properties of materials, for evaluating and comparing dynamic response of specific building components and systems, for validation of analytical models, and for validation of

methods used to evaluate field data. Examples of uses of dynamic test results are given for two wall assemblies.

6061 (CONF-8206130—, pp 265-312) **Field study of the effect of wall mass on the heating and cooling loads of residential buildings.** Burch, D.M.; Remmert, W.E.; Krintz, D.F.; Barnes, C.S. (National Bureau of Standards, Washington, DC). Aug 1983. NTIS, PC A21/MF A01.

From Building thermal mass seminar; Knoxville, TN, USA (2 Jun 1982).

Six test buildings were extensively instrumented for measuring heating and cooling loads, wall heat transmission, and indoor temperature and humidity. During these measurements, the effect of wall mass on the heating and cooling loads was observed. These buildings were exposed to a winter heating season, an intermediate heating season, and a summer cooling season. The test buildings were 20 x 20 ft (6.1 x 6.1 m) one room buildings constructed at Gaithersburg, Maryland. These buildings had the same floor plan and orientation. They were identical, except for the wall construction, which was as follows: insulated lightweight wood frame; uninsulated lightweight wood frame; insulated masonry with outside mass; uninsulated masonry; log; and insulated masonry with inside mass. The insulated buildings including the log building were designed to have walls of approximately equivalent steady-state thermal resistance; the uninsulated buildings also were designed to have walls of approximately equivalent steady-state thermal resistance. No reductions in heating energy attributable to wall mass were observed during the winter heating season, when the buildings typically did not float (i.e., some heating energy was supplied each hour). However, during the intermediate heating season and the summer cooling season, when the buildings floated during a portion of the day (i.e., no heating or cooling load occurred during a portion of the day and the indoor temperature rose above, or fell below the indoor set temperature), significant reductions in load attributable to wall mass were observed. Wall mass was observed to have a larger effect when it was placed inside the wall insulation as opposed to outside the wall insulation.

6062 (CONF-8206130—, pp 313-330) **In-situ measurements of building envelope thermal properties.** Grot, R.A. (National Bureau of Standards, Washington, DC). Aug 1983. NTIS, PC A21/MF A01.

From Building thermal mass seminar; Knoxville, TN, USA (2 Jun 1982).

Various techniques currently available for analysis of air infiltration and heat transfer across building envelope systems are described. The former includes tracer gas and pressurization, and the latter includes thermal infrared sensing, calorimetry, and the use of heat flow sensors.

6063 (CONF-8206130—, pp 353-404) **Earth contact thermal mass effects in building design.** Shipp, P.H. (Owens-Corning Fiberglas Technical Center, Granville, OH). Aug 1983. NTIS, PC A21/MF A01.

From Building thermal mass seminar; Knoxville, TN, USA (2 Jun 1982).

The thermal stability of the ground can effectively contribute to energy efficient building designs. As soil is a relatively poor thermal insulation, its unique characteristics result primarily from the large effective mass available for thermal storage and temperature moderation. It is therefore generally necessary that the thermal resistance of building elements near the ground surface be supplemented by insulation. The role of soil in the thermal performance of a building's exterior envelope is reviewed as well as conclusions drawn from current research in earth contact heat transfer. The function of the ground as a thermal moderator is examined and contrasted against its effectiveness solely as a thermal insulation. The implications of these findings are extended to the thermal flywheel effect of the soil surrounding a building. Insulation placement in basements, unvented crawlspaces and slab-on-grade construction is examined using an experimentally verified transient, two-dimensional finite difference program. Weather data for five US cities were selected to extend the comparisons over a broad range of climates. Soil thermophysical properties are determined by the soil composition, density and moisture content. Although thermal conductivity is very sensitive to moisture content, soil thermal diffusivity is comparatively stable under changing conditions. As a consequence, detailed modeling of soil moisture migration is not essential to general earth contact building heat transfer studies although it can serve to enhance the accuracy of specific research tools.

6064 (DOE/CH/00178—T19) **Your home energy audit: the first step to more energy-efficient living.** (Solar Energy Research Inst., Golden, CO (USA); Oak Ridge National Lab., TN (USA)). [nd]. Contract AC02-77CH00178. 29p. NTIS PC A03/MF A01. Order Number DE84003587.

This brochure covers the following: energy-conserving practices, energy conservation measures, and renewable resource measures. Sources of more information are listed. (MHR)

6065 (DOE/CS/20425—T1) **Energy cost control guide for multifamily properties.** (Berkeley Planning Associates, Inc., CA (USA); Energyworks, Inc., West Newton, MA (USA)). 1981. Contract AC03-78CS20425. 104p. NTIS, PC A06/MF A01. Order Number DE84002866.

The following topics are covered: the Energy Cost Control Program, no cost/low cost energy conservation measures for apartments, and capital investment for energy cost control. (MHR)

6066 (DOE/R2/06031—1) **Heating/cooling standards implementation study: New York, New Jersey, Puerto Rico, Virgin Islands. Final technical report.** (Forward Management Associates, Inc., New York (USA)). 1982. Contract AC02-81R206031. 302p. (In English and Spanish). NTIS, PC A14. Order Number DE83014759.

Paper copy only, copy does not permit microfiche production.

An assessment and evaluation are presented of the State Energy Conservation Code compliance in New York and New Jersey and the cooling standards implementation in Puerto Rico and the Virgin Islands. The issue of improving data collection systemization is covered. Conclusions gleaned from structurally analyzing the data/information collected in the field and the attendant recommendations which follow from the findings are articulated. Tables, charts, descriptive illustrations, and other graphics are included. (MHR)

6067 (DOE/R6/10952—T1) **Reflective barriers for reducing home roof heat loss.** Caskey, D.L. (Caskey (David L.), Albuquerque, NM (USA)). Aug 1980. Contract FG46-79R610952. 23p. NTIS, PC A02/MF A01. Order Number DE84003452.

Reflective aluminium foil was installed on the rafters of a pitched-roof single-family dwelling in Albuquerque, NM. The hypothesis was that such a layer of foil would reduce winter heat loss through the roof, by reducing the high nighttime radiation losses experienced in the high deserts of the US Southwest. Predictions were that overall house heat losses would decrease about 4 percent in the moderately insulated test house. Experimental results show only about a 1 percent decrease. While instrumentation confirmed a 25 percent decrease in heat loss through the roof at night, as predicted, the foil also decreased heat gain through the roof during sunny days. The daytime effect was even greater - a 40 percent decrease in heat gain was measured. The 40 percent decrease, effective for about 8 hours/day, yields a 24 hour effect of about 13 percent. The smaller 25 percent night effect operates over a longer period of about 12 hours per day, resulting in a net 24 hour effect of 12.5 percent. Hence, the net effect is only a statistically insignificant .05 percent. Metered furnace gas usage confirms the extremely small overall effect on home heating. Thus we must conclude that the foil, as installed on the test house, is not an effective method of reducing winter heat loss. On the other hand, the data would indicate that its use as an insulation technique for preventing summer heat gain has considerable merit.

6068 (DOE/R6/10963—T1) **Evaporative precooler retrofit for air cooled condensers. Small scale appropriate technology grant program.** Campbell, J.R. (Campbell (James R.), Carrollton, TX (USA)). [nd]. Contract FG46-79R610963. 32p. NTIS, PC A03/MF A01. Order Number DE84003543.

Three methods of evaporative cooling were evaluated; direct evaporative cooling of the condenser coil (spray directly on condenser coil), wetted media acting as evaporator and eliminator, and a spray type with eliminator. The direct spray achieved the lowest head pressure and greatest energy savings under all conditions. The major disadvantage in applying this method to an existing unit not designed for direct evaporative cooling is the inevitable build up of scale and decrease in heat transfer of the condenser. The direct spray type system should not be considered without some type of water treatment. The wetted media provided a temperature that had a closer approach to wet bulb temperature and less stratification than the spray system with eliminator. Its primary disadvantage was a reduction in air flow to the condenser of about 14%. This reduced air flow limited the effectiveness of the system at higher wet bulb temperature and could cause the condenser to use more energy as wet bulb approached dry bulb temperature. The spray with eliminators appears to be the best compromise for areas which have the possibility of high wet bulb temperature from time to time. The primary disadvantage, other than the somewhat lower approach to wet bulb, is the duct work required to allow the spray system and eliminator to be installed. A fourth method was considered - injection of precooled air to the condenser coil. Under this approach the condenser coil functions normally with an injection system around its perimeter.

6069 **(DOE/R6/10970—T1) Insulating window shutters project. Final report.** (Sunshine Insulation, Albuquerque, NM (USA)). [nd]. Contract FG46-79R610970. 6p. NTIS, PC A02/MF A01. Order Number DE84003489.

Between November 1979 and August 1980 twelve insulating window shutters were built and installed. The design varied little from the original proposal. The shutters easily fulfilled the technical requirements of insulating windows effectively, reducing infiltration losses through windows and reducing radiant loss of body heat to cold window surfaces. The primary objectives were to find an effective shutter design and to determine if the design was competitive with storm windows and insulating draperies. The final design is probably much more effective than storm windows and draperies but the retail cost of the shutters does not make them competitive with storm windows and draperies except for the most dedicated conservationists.

6070 **(DOE/R6/11996—T1) Final report, Part I.** Upham, R.W. (Upham (Russell W.), Bella Vista, AR (USA)). 20 Jun 1983. Contract FG46-80R611996. 23p. NTIS, PC A02/MF A01. Order Number DE84003487.

An energy conservation retrofit for a dwelling is described. The retrofit included weatherization, cooling options, solar water heating, and the use of wood fuels. Successes and failures are detailed. (MHR)

6071 **(DOE/R6/11998—T1) Ultrasonic spray evaporative air coolers. Final report.** (Environmental Technical Consultants, Inc., Little Rock, AR (USA)). Apr 1982. Contract FG46-80R611998. 30p. NTIS, PC A03/MF A01. Order Number DE84003422.

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Theoretical and experimental studies on the development of an energy-efficient evaporative air cooling device employing ultrasonic spray nozzles is discussed. The following works were performed during the project period: (1) Feasibility study of a breadboard model of the evaporative cooler, (2) design of a prototype cooling unit for laboratory and field studies, and (3) preliminary survey of potential applications.

6072 **(FSEC-CR—84-83(RD)) Instrumentation for side-by-side testing of the energy attributes of mobile homes. Residential Conservation Demonstration Program. Final report.** Cromer, C.J. (Florida Solar Energy Center, Cape Canaveral (USA)). 15 Jun 1983. 66p. NTIS, PC A04/MF A01. Order Number DE84900008.

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Two 14 x 70 ft (nominal) mobile homes located at Tallahassee, Florida have been monitored for energy use on a side-by-side basis. One home had typical HUD approved insulation values: (1) R-7 in the walls, (2) R-11 in the floor, (3) R-14 in the roof and, (4) insulated doors. The second home had: (1) R-13 in the walls (increase of R-6), (2), R-18 in the floor, (3) R-22 in the roof, (4) insulated door, (5) storm windows (increase of R-16), (6) air infiltration barrier in the walls, and (7) an additional R-7 hot water tank insulating jacket. The second home had a smaller capacity refrigerator (14.1 cu. ft.), while the first home had a refrigerator of 15 cubic feet. Each home's energy use was monitored by individual kWh meters on four power consumption circuits: (1) heat/AC, (2) refrigerator, (3) hot water and, (4) lights/range. The power usage of all instrumentation was separately monitored by a kWh meter. The homes were unoccupied, but occupancy is simulated in each home by a microcomputer system that switched the lights and range and drew hot water such that occupancy usage is identical for both homes. Internal loads similar to those created by a family of four were simulated. The microcomputer also monitored kWh, Btu and gallon use and the seconds the exterior doors are open. Results after one year indicate a measured reduction in energy consumption of approximately 10% in the extra-insulated mobile home. This provides a straight payback for the total energy package of 4.1 years. However, no reduction in air infiltration was provided by the additional infiltration barrier in the walls. If this costly and apparently ineffective option is removed from the energy package, the straight payback becomes about 2.5 years. Actual consumption data, separate component analysis, and a complete description of instrumentation and method are provided along with the software developed for the microprocessor.

6073 **(LBL—14893) Correlations for convective heat transfer from room surfaces.** Altmayer, E.; Gadgil, A.; Bauman, F.; Kammerud, R. (Lawrence Berkeley Lab., CA (USA)). Oct 1983. Contract AC03-76SF00098. 28p. (CONF-830640—10). NTIS, PC A03/MF A01. Order Number DE84004966.

From ASHRAE conference; Washington, DC, USA (26 Jun 1983).

Correlations of the rate of heat transfer from room surfaces to the enclosed air, based on empirical and analytic examinations of convection in two-dimensional enclosures, have been developed. The heat-transfer data base from which the correlations were derived was generated by a validated numerical-analysis computer program. Simulations were performed for a variety of temperature and geometry boundary conditions. The correlations extracted from this data base express the heat-transfer rate in terms of boundary conditions relating to room geometry and surface temperatures. The correlations are applicable to a class of room configurations with cold and warm surfaces on opposite vertical walls. The numerical-analysis technique is presented, the generalized methodology for developing simplified correlations is described, and correlation results are presented and compared to results using standard ASHRAE techniques. It is shown that the correlation significantly improves the accuracy of heat-transfer rate calculations in buildings.

6074 **(NP—4900384) Preliminary economic analysis of H.B. 2032 for Legislative Budget Board.** Cepeda, W.I. (Texas Governor's Energy Advisory Council, Austin (USA). Forecasting and Policy Analysis Div.). 13 Apr 1977. 6p. NTIS, PC A02/MF A01. Order Number DE84900384.

H.B. 2032 calls for the initiation of a study to evaluate the energy conservation potential of state owned buildings. The elements of the study and the enconomic impact of H.B. 2032 are discussed. (MHR)

6075 **(PB—83-249466) Research, development and demonstration of an advanced heat actuated heat pump, Phase I. Final report, October 1980-31 August 1982.** Cook, F.B.; Montero, A.R.; Purvis, E.M. Jr. (Columbia Gas System Service Corp., Columbus, OH (USA)). 30 Sep 1982. 57p. NTIS, PC A04/MF A01.

The objective of Phase I is the research, development and demonstration of a basic heat pump refrigeration circuit and the heat exchanger interface with the controlled and ambient environments in both cooling and heating modes of operation. The target performance characteristics for the heat pump system are a site energy COP of 0.80 for cooling and 1.50 for heating (including parasitic power consumption) at outdoor design temperatures of

95F and 47F, respectively. The basic refrigeration circuit uses a high efficiency absorption process with a novel absorbent/refrigerant pair.

6076 **(PB—83-249482) Phase II development and commercialization of an ultra efficient residential water heater of the pulse combustion type. Annual report November 1981-November 1982.** Kolodgy, R.J.; Liljenberg, G.W. (American Gas Association Labs., Cleveland, OH). Nov 1982. 47p. NTIS, PC A03/MF A01.

This study was undertaken to develop ultra efficient domestic water heaters of the pulse combustion type. A.G.A.L., GRI and a participating manufacturer are cooperating in the design of the storage tank and components. During development and testing consideration is given to common components for all models, to manufacturing techniques and to consumer needs. Appropriate American National Standards Institute (ANSI) and Department of Energy (DOE) tests are performed. The pulse combustion burner, being direct vent, does not require a chimney.

6077 **(PB—83-251017) Field development of a desiccant-based space-conditioning system for supermarket applications. Annual report, February 1982-January 1983.** Cohen, B.M.; Levine, A.H.; Arora, R. (Thermo Electron Corp., Waltham, MA (USA)). Feb 1983. 201p. (TE—4308-42-83). NTIS, PC A10/MF A01.

The use of gas-regenerated desiccant dehumidification systems to provide space-conditioning for supermarkets was investigated. A silica gel-based dehumidification system and related components were installed in a Jewel supermarket as an adjunct to the conventional vapor-compression air-conditioning system. Instrumentation was installed to monitor this hybrid system and to allow performance comparisons with the conventional vapor-compression system operating alone. Data collected were used to develop load models for the building and to correlate indoor and ambient conditions to the energy consumption by the air-conditioning and refrigeration systems. The expected reduction in refrigeration energy consumption with decreasing store humidities was verified. The load models were used in conjunction with system characteristics to obtain cooling season cost projections for both systems operating under different conditions. Initial estimates indicate that payback periods of the hybrid system could be under 1 year.

6078 **(SOL—83-16) Commercial buildings energy services model of the PILOT system.** Avi-Itzhak, B.; McAllister, P.H. (Stanford Univ., CA (USA). Systems Optimization Lab.). Aug 1983. Contract AT03-76ER72018. 57p. NTIS, PC A04/MF A01. Order Number DE84002098.

The Commercial Buildings Energy Services Model (CBEM) is a model of energy use in commercial buildings in the US. Demands for energy services are generated by the existing stocks of the various categories of commercial buildings and are determined by their type, floor area, region of location and conservation level. The total floor area stock of buildings is determined by population size and age distribution and by sectoral levels of economic activity. Interfuel and capital-fuels substitutions take place through adjustments in the stocks of buildings and energy systems in response to changing costs. This is effected through a choice of three conservation levels for newly added buildings, retrofitting of initially existing buildings and a possibility to select among energy systems with various fuel efficiencies and capital costs. The model is bi-regional and it keeps a separate account of buildings stocks in each of the two regions. Energy conversion systems are also region specific. The CBEM is a multi-period linear programming model and can be run as an integral part of the PILOT model or independently on its own. In the latter case, the model is driven by a minimand cost function and produces the least cost strategy for the underlying projections of population, economic activity levels and price profiles.

6079 **(TENRAC/EDF—093) Energy conservation through microprocessor-based control. Final report.** Russell, B.D.; Heller, R.P.; Gerloff, G.W.; Perry, L.W. (MICON Engineering, Inc., College Station, TX (USA)). Jun 1983. 33p. NTIS, PC A03/MF A01. Order Number DE84900436.

A special microprocessor-based energy management system (EMS) was installed at the Embers Restaurant in Denison, Texas. This EMS was reprogrammed as necessary to implement the various demand limiting algorithms that were tested. The results of these tests indicated that simplistic approaches to demand limiting were ineffective or unacceptable to the building operators. The final algorithm utilized contained a predictive slope sensitive algorithm that made use of varying averaging times to overcome some of the characteristics of restaurant loads. The conclusions were that a statistical demand profile can be effectively used, the characteristics of common demand limiters are in need of improvement, and the characteristics of many restaurant loads present a special problem to demand limiting algorithms.

6080 **Residential energy use and conservation in Denmark, 1965-1980.** Schipper, L. (Lawrence Berkeley Lab., CA). *Energy Policy;* **11**: No. 4, 313-323(Dec 1983). Contract AC03-76SF00098.

New data have been assembled to quantify patterns of residential energy use in Denmark from 1965 to 1980 by fuel and end use. Indicators of the structure and intensity of energy use are developed from basic data and reviewed. Changes since 1972 are quantified and compared with those observed in other countries. The reduction in oil use in oil-heated dwellings is shown to be the largest among OECD countries. Elements of past, present, and future Danish conservation policies are reviewed. While many of these are unique and far reaching, the predominant cause of conservation up until 1980 has been short-term measures stimulated primarily by higher energy prices. 16 references, 2 figures, 6 tables.

6081 **Cooling commercial buildings with off-peak power.** Lihach, N.; Rabl, V. *EPRI (Electric Power Research Institute) Journal;* **8**: No. 8, 6-13(Oct 1983).

Large commercial buildings use more electricity for cooling than for heating, and can account for 40% of summer peak demand. A cool storage technique in which compressors chill or freeze water during off-peak periods and the water is circulated during peak hours is in use in 100 commercial buildings. Reports indicate that these systems are economical, although little information is available, but engineers are hesitant to incorporate them because of possible damage from leaks or rust and other uncertainties. The Electric Power Research Institute is evaluating the performance of several systems to answer some of the operating and maintenance questions raised by engineers. 3 references, 3 figures. (DCK)

3202 Transportation

REFER ALSO TO CITATION(S) 6128

6082 **(CONF-831142—2) Waste heat recovery fluids for heavy-duty transportation bottoming cycle systems.** Holtz, R.E.; Uherka, K.L.; Krazinski, J.L. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 12p. NTIS, PC A02/MF A01. Order Number DE84003993.

From Automotive technology development contractor coordination meeting; Dearborn, MI, USA (13 Nov 1983).

The work effort associated with the Waste Heat Recovery Fluids for Heavy-Duty Transportation Bottoming Cycle Systems Project at Argonne National Laboratory (ANL) is summarized. As part of this effort, information on fluid properties and bottoming cycle requirements was obtained from the following sources: a literature search, conversations with researchers, and site visits. It was found that adequate thermophysical property data are available for the more commonly used organic fluids, which have stability temperatures below ~ 750°F, but that a technology gap exists for higher temperature fluids. A single-component fluid property subroutine has been developed and integrated into Argonne's Rankine bottoming cycle (RBC) Performance Code. Current efforts focus on documenting and integrating a multicomponent fluid property subroutine into the code.

6083 **(DOE/CS/40043—T1) Assessment of fuel evaporation control measures for small, above-ground storage tanks. Final report.** Steiker, A.B.; Ciliano, R. (Mathtech, Inc., Princeton, NJ (USA)). 20 Feb 1981. Contract AC01-78CS40043. 147p. NTIS, PC A07/MF A01. Order Number DE84004122.

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Gasoline vapor loss control on small, above-ground storage tanks (i.e., 250 to 1000 gallons) was studied. Issues examined included the theoretical basis for vapor loss; market distribution and characteristics of storage tanks; vapor loss control methods; potential for loss prevention; environmental impacts of vapor emissions; and vapor loss and fuel quality issues associated with the storage of various gasohol blends. As part of this research, a computer simulation model, the Gasoline Tank Simulation Model (GTSM) was developed to study this complex process and provide estimates of vapor loss for a wide range of conditions. In addition, a field experiment was performed to test certain control devices, in particular the vapor seal, and to validate the GTSM model. Regarding conservation potential, it is estimated that from the 2.2 million tanks in the nation, about 80 million gallons of gasoline are lost through evaporation each year. Approximately 14 million gallons can be saved through simple means such as shading the tanks and coating with reflective paint. An additional 48 million gallons can be saved through the use of control devices. Both the pressure cap and vapor seal appear to be very effective vapor loss control devices which merit serious attention on the part of small, above-ground tank owners. Given current price levels for gasoline, the purchase of a pressure cap would, for example, have a simple payback of less than 2 years for virtually all tank sizes and regions of the country. In many instances, a payback of less than 1 year is indicated.

6084 **(DOE/PE/70045—T4) Fuel purchasing patterns and vehicle use trends: data display.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Sep 1982. Contract AC01-78PE70045. 117p. NTIS, PC A06/MF A01. Order Number DE84003940.

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The steps taken to prepare the data for analysis, including error correction, smoothing, and collapsing to monthly summary records are discussed. This preparation yields a manageable data base which includes monthly summary statistics on travel and fuel use. An overview of available data on in-use fuel economy, vehicle miles of travel, and fuel demand is given highlighting the quarterly trends in these variables. The format used in the more detailed tables is introduced. The data presented are divided into three parts: in-use fuel economy, vehicle miles of travel, and fuel demand and fuel prices. The hierarchical structure into which the individual tables fit is summarized. A comprehensive list of tables is compiled.

6085 **(DOE/PE/70045—T5) Use of principal components analysis to identify trends in travel, fuel economy and fuel demand. Analysis memorandum. Task 23, Subtask 3.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). 29 Oct 1982. Contract AC01-78PE70045. 19p. NTIS, PC A02/MF A01. Order Number DE84003935.

This preliminary work with PCA shows the power of the technique in searching for possible trends and patterns in the data. The results presented show that overall intensity of use is more important than any cyclical patterns in determining how much a vehicle will be driven. While the expected seasonal driving cycle is present in the data, so are a number of other patterns that appear to be roughly equal in importance. At this point PCA does not provide much guidance in sorting out the eleven eigenvectors of nearly equal magnitude. The analysis does indicate that the straightforward seasonal trend is really a more complicated combination of several different patterns.

6086 **(DOE/PE/70045—T6) Modifications of the DOE highway fuel consumption model. Subtask 2 report.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). 30 Aug 1982. Contract AC01-78PE70045. 52p. NTIS, PC A04/MF A01. Order Number DE84003938.

Recent work performed to modify and update the Highway Fuel Consumption (HFC) model is described. Recent analyses and additions which have been made to improve the usefulness of the HFC model as a flexible tool for energy conservation policy and program evaluation are documented. Actual on-road fuel economy estimates for pre-MY1975 passenger cars are developed from household fuel purchase and travel surveys. The analysis assesses the changes in the output of the HFC model which result from the incorporation of these data into the model framework. The influence of trends in odometer and vehicle levels on in-use fuel economy is examined. A vintage-related index of the sensitivity of in-use fuel economy to vehicle odometer levels and changes in average daily miles of travel is constructed and incorporated into the HFC model. The feasibility of incorporating an exogenous forecast of total highway travel into the HFC model for the purpose of adopting the fuel consumption output to correspond with econometrically-based projections of vehicle use is examined. A brief literature survey of available econometric forecasts of total highway VMT is performed; and a methodology for including these forecasts within the HFC model structure is developed and tested.

6087 **(DOE/PE/70045—T8) Car and heavy-duty truck technology and fuel economy projections: baseline for the 1980-1990 time period.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Dec 1981. Contract AC01-78PE70045. 33p. NTIS, PC A03/MF A01. Order Number DE84003943.

The methodology used to forecast technology introduction and fuel economy is reviewed. A brief summary of the technologies considered for introduction in the 1980-1990 time frame. The resulting baseline technology and fuel economy forecasts consistent with current environmental standards and the assumed fuel price scenario are detailed.

6088 **(DOE/PE/70045—T9) Development of a base case estimate of truck fuel demand in the 1967 to 1980 time period. Subtask II report. Task No. 17.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Feb 1982. Contract AC01-78PE70045. 18p. NTIS, PC A02/MF A01. Order Number DE84003944.

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Actual trends in fuel demand are illustrated briefly and the Base Case is outlined. The components of the trends in fuel efficiency are discussed. A methodology for the analysis of fuel savings attributable to the specific components of fuel efficiency is outlined. (MHR)

6089 **(DOE/PE/70045—T10) Fuel purchasing patterns and vehicle use trend analysis: the household demand for travel. Final report.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). 14 Jan 1983. Contract AC01-78PE70045. 32p. NTIS, PC A03/MF A01. Order Number DE84003939.

A categorical model of household travel demand that explores some of the reasons for variations between households is described. The objectives of this work are to determine whether or not a categorical framework is appropriate for this type of modeling effort and to identify some of the factors influencing the household travel decision. Data for this study are drawn from the NPD data base which covers the 12 calendar months of 1981. The data base was derived from a market research survey of US families developed by NPD Research, Inc. During the period over which these data were collected, the survey participants recorded approximately 369,000 motor fuel purchases. The data base includes demographic information for the vehicle owner's household, vehicle description data, odometer readings at the beginning and ending of each month, and information about individual fuel purchases including amount of fuel and total cost. The household and vehicle detail makes this data base a suitable source of information for a model of household travel demand.

6090 **(DOE/PE/70045—T11) Analysis memorandum: design factor update. Task 24, Subtask 1.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). 1 Oct 1982. Contract AC01-78PE70045. 54p. NTIS MF A01. Order Number DE84003934.

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The design factor update study was conducted in two phases. Phase one established the data base and generated sensitivity coefficients at a highly disaggregated level - for each combination of manufacturer, model year, engine family, transmission type, and technology group. The coefficient distributions were analyzed for dependence on parameter values and on EPA test results (e.g., the ETW coefficient for EPA city mpg's as linear functions of ETW and/or EPA city mpg). Preliminary design factors also were generated at a series of aggregated levels. These interim results provided design factor coefficients at frequently encountered aggregations and led to revised specifications for the second phase. Phase two of the study focused on developing statistical models for ETW, PAU, and N/V factors that accounted for the variation of design factor sensitivities with parameter values. This portion of the study also examined whether PAU or N/V factors were dependent on ETW, since there exist correlations between changes in vehicle weight and variation in the other design parameters. The study concluded with a provisional statistical model.

6091 **(DOE/PE/70045—T14) Analysis memorandum recent trends in light-duty truck performance.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). 1 Oct 1982. Contract AC01-78PE70045. 8p. NTIS, PC A02/MF A01. Order Number DE84003941.

Trends in the response of light-duty truck (LDT) owners to the 1979 fuel shortage and subsequent rise in fuel prices are examined. Data are provided on LDT driver behavior and VMT trends for a companion analysis to passenger car fuel consumption. Findings under this work effort are reported.

6092 **(DOE/PE/70045—T15) In-use fuel economy trend analysis for light-duty trucks.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Jan 1983. Contract AC01-78PE70045. 39p. NTIS, PC A03/MF A01. Order Number DE84003933.

The more generic trends in light-duty truck fuel economy shortfall are reviewed. A summary of data sources available for use in the analysis are provided. A brief discussion of the individual data sources, their collection techniques, and their limitations is presented. The methods used to eliminate outliers and biased data are presented. A series of tables detailing shortfall for alternative aggregations of the sample data are presented. A brief discussion of the significance of the trends observed in each of the aggregations also is included. (MHR)

6093 **(DOE/PE/70045—T16) Automotive technology trends - update for TCSM-II.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). 17 Sep 1982. Contract AC01-78PE70045. 31p. NTIS, PC A03/MF A01. Order Number DE84003937.

A model called the Technology/Cost Segment Model (TCSM) was developed for the DOE to track technological innovations and manufacturer plans to introduce such innovations to improve fuel economy. The TCSM serves as an accounting structure that utilizes discrete technology improvements to automobiles to calculate the net fleet fuel economy. In order to gauge the effect of the new developments on fuel economy, data on the discrete technologies such as the data of availability, fuel economy gains, engineering constraints and market penetration issues were carefully reevaluated and the new data were entered into the TCSM. The new data are described in four categories: new technology concepts/developments, revised manufacturer product plans, technology market penetration for diesels, and size class mix shift. Data in the first three categories were included into the TCSM, but size class mix shift is accounted for exogenously. Fuel economy results obtained from a sample run are provided to provide a quantification of the extent of change in fuel demand as a result of the data modifications from previous forecasts.

6094 **(DOE/PE/70045—T18) Revised projections of fuel economy and technology for highway vehicles. Task 22. Final report.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). 15 Jun 1983. Contract AC01-78PE70045. 68p. NTIS, PC A04/MF A01. Order Number DE84003936.

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Both the methodology used to forecast fuel economy and the technological and tooling plan data central to the derivation of the forecast for all those vehicle classes are updated here. Forecasts were prepared for a scenario where oil prices stay flat through 1985 (in current real dollars) and increase at the rate of one percent per year in the 1985 to 1995 period. Estimates of the mix of vehicles sold and projections for diesel penetration are documented. Revised forecasts for cars and light duty truck analysis are detailed. Heavy-duty truck fuel economy forecast revisions are described. The DOE automotive R and D programs are examined in the context of the newly revised projections. (MHR)

6095 **(PB—83-247833) Energy options and policy issues in developing countries. Working paper.** Fallen-Bailey, D.G.; Byer, T.A. (International Bank for Reconstruction and Development, Washington, DC (USA)). [nd]. 118p. (WP—350). NTIS MF A01.

This paper reviews the energy resources of developing countries, with particular emphasis on those which import oil. It discusses the nature of these resources, the cost of developing them and the policy issues raised in doing so. The need for and implementation of national energy planning, energy demand management, conservation and pricing policy are described. Energy development strategies for countries in energy surplus, energy balance and energy deficit are discussed, as are problems related to petroleum refining and energy use in the transport sector. Issues related to power generation and fuel substitution and the relevant costs are reviewed. (Copyright (c) 1979 by The World Bank.)

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 5829, 5991, 6079, 6082, 6120

6096 **(DOE/CS/24448—T3) Third-party financing: increasing investment in energy-efficient industrial projects.** (Alliance to Save Energy, Washington, DC (USA)). Nov 1982. Contract FG01-80CS24448. 123p. NTIS, PC A06/MF A01. Order Number DE84003984.

The purpose of this report is to encourage third-party financing of industrial process energy-efficiency projects. The primary considerations that affect the viability of third-party financing of industrial processes are identified, basic approaches to structuring investments are identified, and guidance is provided to the industrial firm as well as insurance companies, corporate investors, investment banking firms, leasing firms, banks, and other third-party investors on how the financing approaches can be applied. How federal tax laws affect the viability of third-party financing is also identified.

6097 **(DOE/OR/20808—1-Rev.1-Draft) Feasibility study for a thermal utility plant utilizing waste heat from the gaseous diffusion plant at Paducah, Kentucky. Revision 1: draft.** (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). 4 Aug 1982. Contract FG05-81OR20808. 104p. NTIS, PC A06/MF A01. Order Number DE84003886.

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An engineering feasibility study and cost estimate were carried for a Thermal Utility Plant (TUP) utilizing waste heat from the Department of Energy (DOE) Uranium Enrichment Gaseous Diffusion Plant (GDP) at Paducah, Kentucky. The Thermal Utility Plant studied herein uses heat pump technology to recover available waste heat from the GDP cooling water stream in the form of subatmospheric water vapor and compresses it to usable process steam pressures. The steam from the TUP would than be utilized in various process applications at an alcohol facility which is proposed to be located adjacent to the TUP site.

6098 **(DOE/PE/70045—T12) Industrial conservation of fossil fuels.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). 15 Jan 1982. Contract AC01-78PE70045. 33p. NTIS, PC A03/MF A01. Order Number DE84003814.

A broad review of industrial efforts at conserving energy, both past and potential, and substitution of alternative energy

sources for current fossil fuel uses is presented. Past efforts of industry to conserve energy are presented. Present and potential industrial processes are examined where electricity competes with fossil fuels. Past modeling efforts at projecting industrial energy conservation are presented and potential modeling efforts utilizing the Industrial Sector Technology Use Model are explored.

6099 **(DOE/PE/70045—T13) Improvements to industrial fuel choice analysis model.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). 18 Jan 1982. Contract AC01-78PE70045. 55p. NTIS, PC A04/MF A01. Order Number DE84003945.

A reduced form of the industrial demand model, IFCAM, was developed as a component of the DOE Two-Sector Gas Equilibrium Model. This overall DOE framework was used to examine the price and fuel impacts of various gas decontrol scenarios. The reduced form industrial demand model (IDM) reflects a more detailed fuel decision logic than IFCAM to accurately capture gas/oil switching and a more aggregate industrial data base to cut down computer time. The result of the exercise was a model which could be run with a large integrated framework but which displayed less industrial detail. Each of the models, IFCAM and the reduced form IDM are described. The major logic flow of each model is outlined and elements that were changed are highlighted. The model changes that were made to IFCAM to reflect reduced form structure are described. Both the model logic changes and data generation required are described. The results of sample IFCAM runs and compares those results to the reduced form model are described.

6100 **(DOE/R6/10995—T1) Morama bean research in Texas: a technical report.** Bousquet, J.E. (Center for the Study of Human Adaptation, Austin, TX (USA)). Jul 1982. Contract FG46-79R610995. 45p. NTIS, PC A03/MF A01. Order Number DE84003127.

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The search for drought-resistant crops has energy-saving as well as water-saving goals. The agricultural potential of morama beans (Bauhinea esculenta, also known as Tylosema esculentum), a plant that grows extensively across southern Africa was investigated. The beans are usually eaten roasted, like peanuts. Morama tubers, which store water to assure the plant's survival in drought years, may be uprooted and eaten as a source of moisture and some other nutrients. The goals of the morama project were specifically to discover the tolerance of morama for Texas agronomic conditions, to discover the ideal conditions and methods of cultivation, to demonstrate the productivity and forage potential of the plants grown at various sites in Texas, and to measure the nutritional quality of the edible parts of this plant.

6101 **(DOE/R6/12013—T1) Natural farming in Louisiana.** Hair, M. (Hair (Michael), Lafayette, LA (USA)). 31 Mar 1983. Contract FG46-81R612013. 51p. NTIS, PC A04/MF A01. Order Number DE84003136.

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This project evaluates the possibility of producing rice and winter grain on the Gulf Coast of Louisiana using very little or no fossil fuel inputs. Radically different natural farming techniques pioneered in Japan were used to establish a continuous yearly cycle of rice, wheat and clover culture with human labor substituted where possible for mineral fuel dependent inputs. An examination of energy flows in food producing systems generally forms the theoretical framework for a discussion and comparison of particular agricultural systems. The components of a complete yearly cycle of farming practices were carried out experimentally, observed, and evaluated. Several varieties of wheat and cover crops were planted in the fall and harvested in the spring, several varieties of rice were broadcast no-till, irrigated, weeded, harvested and milled, and measurements and observation of stand, weeds, insects, disease, nutrients, and harvesting and milling methods were made and discussed. Human labor inputs were recorded and an economic and energetic evaluation of the overall method was made.

6102 **(DOE/R6/12056—T1) Energy from the waste of secondary wood producers.** Richards, W.H. (Richards (William H.), Silsbee, TX (USA)). Jan 1982. Contract FG46-80R612056. 40p. NTIS, PC A03/MF A01. Order Number DE84003544.

The feasibility of using wood wastes produced in the Houston metropolitan area as an energy source was studied. The resource available was defined and the processing and marketing possibilities were considered. The economic feasibility of a venture that would gather, process, and market the wood fuel was evaluated. (MHR)

6103 **(DOE/R6/12072—T1) ARK-o-hol community experiment group: a cooperatively operated greenhouse heated with low-grade waste heat from an adjacent alcohol distillation plant. Final report.** (ARK-o-hol Community Experiment Group, Scranton, AR (USA)). 1983. Contract FG46-81R612072. 11p. NTIS, PC A02/MF A01. Order Number DE84003488.

In order to prove that low-grade waste heat (from an alcohol distillation plant, in this case) could successfully be transported and recycled, a 28′ x 60′ greenhouse was designed and constructed adjacent to and connected by plumbing with an operating alcohol distillation plant. Hot water in the return lines of heat exchangers in the distillation column of the alcohol plant was emptied into a 20′ x 20′ in ground heat storage tank within the greenhouse. This heated water was then circulated throughout the greenhouse by means of 7′ x 10′ floor plates (surplus reefer heat exchangers). The heat-storage tank, drawing its heat from the distillation column waste-heat, in addition to daytime solar gain, maintained a temperature of 62 to 65 degrees by day, dropping to 60 degrees at night, provided the greenhouse with an average of 60,000 Btu's per hour of nighttime usable heat. The greenhouse was operated throughout the winter 1982/1983 which had unpredictable temperatures climbing to 85 degrees, followed immediately by a week of 18 degrees. In April 1983, 18,500 tomato plants and more than 5000 other vegetables and house plants, were ready for harvest, although no supplemental heater was used, the only heat being distillation plant waste heat and daytime solar gain.

6104 **(EGG—2241) Scrap tires: a resource and technology evaluation of tire pyrolysis and other selected alternate technologies.** Dodds, J.; Domenico, W.F.; Evans, D.R.; Fish, L.W.; Lassahn, P.L.; Toth, W.J. (EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1983. Contract AC07-76ID01570. 102p. NTIS, PC A06/MF A01. Order Number DE84003924.

The results of a technical and economic evaluation of scrap tire pyrolysis are presented and some other alternative uses for scrap tires are discussed. A scrap tire, by definition in this report, is one for which there is no economic end use. Information is presented on the scrap tire resource, pyrolysis processes, pyrolysis products (char, oil, and gas), markets for these products, and the economics of tire pyrolysis. A discussion is presented on alternative ideas for using scrap tires as an energy resource.

6105 (OEFZS-GF—38/82, pp 69-74) **Warm water preparation through rotting heat.** Graefe, G. Mar 1982. (In German). Oesterreichisches Forschungszentrum Seibersdorf, Vienna.

In Information colloquium on rape utilisation.

Experiments for warm water preparation and room heating showed that 1 metric ton of rotting wine grape marc is able to produce heat quantities of 100 - 500 kWh. The hot rotting process is suitable as a continuous source of heat which lasts up to several weeks or months according to its dimension. Specially developed heat exchanges for the utilisation of biomass are presented.

6106 (OEFZS-GF—38/82, pp 75-84) **Composting heat utilization for warm water preparation.** Tuschl, P. Mar 1982. (In German). Oesterreichisches Forschungszentrum Seibersdorf, Vienna.

In Information colloquium on rape utilisation.

An aerobic rotting of 2.100 kg fresh material of grape marc was used to produce warm water. The highest rotting temperature during the experiment was about 67°C. Warm water was gathered daily till water temperature had declined to 40°C. Calorific measurements showed that only 31,5% of the initial energy content of the grape marc could be converted by the microbial flora, and only 4,3% of the latter were used for producing warm water. At the

present stage the tested system is unsuited for the production of warm water because the microbial activity is very low and the efficiency of energy conversion is very poor.

6107 (OEFZS-GF—38/82, pp 85-90) **Low temperature heating of a dwelling-house using the rotting heat of wine grape marc.** Schneider, P. Mar 1982. (In German). Oesterreichisches Forschungszentrum Seibersdorf, Vienna.

In Information colloquium on rape utilisation.

Heat exchangers made of aluminium or PVC were installed in rotting boxes (20 m^3 and 55 m^3) for utilisation of heat emitted during the rotting process of wine grape marc. The produced warm water was used for heating a dwelling-house and a plastic tent-greenhouse with floor-heating. The first results showed that the capacity of the rotting system was too small so that the necessary constant temperature could not be maintained. The experiment are being continued.

6108 (PB—83-240416) **Dynamic insulation: a theoretical analysis of thermal insulation through which a gas or fluid flows.** Anderlind, G.; Johansson, B. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1983. 71p. NTIS, PC E04/MF E01.

This report deals with an unconventional insulating technique called dynamic insulation, in other words a thermal insulation through which a gas or fluid is transported.

6109 (PB—83-249508) **Advanced technology ladle preheater research, development, field test and commercialization program. Final report, January 1980-December 1981.** Battles, D.D.; Smith, D.; Ma, K. (Thermecon, Atlanta, GA (USA)). Jan 1982. 72p. NTIS, PC A04/MF A01.

Ladle preheating is one of the most inefficient uses of gas in the iron and steel industry. The best current technology employs an open burner mounted on a refractory wall firing into a ladle, with the exhaust product exiting through the gap between the ladle and the burner wall. Development of a sealed, recuperated firing system would raise the thermal efficiency from approximately 10% for current systems for 60% or better. This improvement would result in reduced fuel costs and shortened heating cycles. The first advanced ladle heater system was developed, fabricated, installed and tested. By using a single burner and metallic recuperator, the system produced 1100F preheated air and heated a 110-ton ladle with a thermal efficiency of 59%. The field test was completed. Over 20 advanced systems have been sold since the successful completion of the field test.

6110 (PB—83-249524) **Selected energy efficient industrial technology in Europe and Japan. Final report, May 1979-February 1983.** Fassbender, A.G. (Battelle-Northwest, Richland, WA (USA). Pacific Northwest Lab.). 15 Jan 1983. 132p. NTIS, PC A07/MF A01.

The document describes a selected number of industrial technologies currently in use or under development in Europe and Japan. These technologies have the potential for widespread use in U.S. industry. The technologies covered include burners, aluminum melters, kilns, fume incinerators and an experimental glass furnace.

6111 (PB—83-255422) **Waste heat recuperation for aluminum furnaces. Final report, Novemer 1981-December 1982.** Russell, A.D.; Smeltzer, C.E.; Ward, M.E. (Solar Turbines, Inc., San Diego, CA (USA)). Apr 1983. 89p. (SR—82-R-5015-13). NTIS, PC A05/MF A01.

The report covers the effort in a one year program in advancing recuperation technologies suitable for the aluminum industry. The program included a survey of industry processes and industry interest in recuperation; performed comprehensive evaluations of candidate recuperator materials; and explored possible designs of prototype recuperators that would be suitable for this challenging environment. A materials test chamber was constructed and installed on an aluminum reclamation furnace. Six stainless steels, seven superalloys, and eight ceramic materials were exposed to the furnace stack environment and furnace duty cycle at material temperatures ranging from 1000F to stack temperature (2100F) for up to 2500 hours. Exposed materials were analyzed for corrosion, recession, and levels and type of attack from the environment.

6112 (PB—83-255513) **Biphase turbine for reverse osmosis desalination. Final report.** Limburg, P.L. (Transamerica Delaval, Inc., Santa Monica, CA (USA). Biphase Energy Systems). Dec 1982. 52p. NTIS, PC A04/MF A01.

A new hydraulic reaction turbine was designed to recover the power available in the high-pressure waste-brine stream of reverse osmosis desalination systems. A reaction turbine sized for reverse-osmosis systems producing 600 gph was built and tested. The turbine performed well driving either a variable-speed pump or an electrical generator. Measured turbine efficiency (shaft power divided by available power) was 63%, compared with a prediction of 67%. The turbine can be built with larger capacity to reduce the size, weight and power consumption of reverse osmosis desalination systems. Efficiency of larger units is predicted to lie in the range of 65 to 70%.

6113 (PB—83-255646) **Report on heat sources for district heating for Atlantic City (New Jersey). Final report 1981-82.** Timmerman, R.W.; Aalto, P.J.; Plunkett, J.; Seldman, N.; Gleason, T.C. (Atlantic City Energy Office, NJ (USA)). 6 Jul 1982. 104p. NTIS, PC A06/MF A01.

Atlantic City with a 1980 population of 40,199 is provided electric service by the Atlantic City Electric, a medium sized investor owned utility. One of its principal generating plants-The Missouri Ave. Station is located within the city and could be a source of heat. The city is investigating a solid waste to energy plant to cogenerate electricity and steam or hot water for district heating. If this occurs the utility would purchase power from the city. The daily production of solid waste which is combustible is in the range of 70-100 tons. At the conclusion of the study there was no assurance that the city would have access to the necessary solid waste since by state law Atlantic County controls the waste stream. The many large hotels, casinos, convention halls that line the Boardwalk are obvious evidence of concentrated heat and cooling demand. The study is notable for the depth and detail of cost and economic calculations made to examine the various alternatives which were explored. The assessment examined the problems and opportunities of initiating a district cooling system by creating large ice piles during the winter using the melt water after its cooling as a needed addition to the city's supply of fresh water.

6114 (PB—83-256669) **High temperature heating system (HTHS). Annual report January-December 1982.** Huebner, S.R.; Prakash, S.N. (Midland-Ross Corp., Toledo, OH (USA). Energy Technology Div.). Mar 1983. 176p. NTIS, PC A09/MF A01.

Natural gas could be an alternative to electric resistance heating for processes above 1800F in furnaces where precisely controlled protective process atmospheres are also needed. This program is intended to develop an integrated radiant tube, burner and heat recovery system to meet this need. Silicon-carbide-based ceramic materials have been selected for the construction of radiant tubes. At the present time, only straight tubes are available, thereby limiting the type of radiant tube configurations that can be developed and marketed. A method of determining thermally induced stresses in radiant tubes has been developed. This analytical tool will aid in the final selection of burner heat release characteristics and optimization of the structural requirements of the tube material. Preliminary design and application engineering of straight circular radiant tube systems have been completed with primary emphasis toward retrofitting heat treat furnaces.

6115 (PB—83-257402) **Factors affecting gas-fired industrial cogeneration system development.** Williams, J.H.; Stafurik, J.W. (Hagler, Bailly and Co., Washington, DC (USA)). May 1983. 64p. NTIS, PC A04/MF A01.

Industrial combined heat and power, or cogeneration, systems are an attractive application for efficient gas-fired technologies. As a result of recent changes in relative energy prices, these systems have exhibited a large economic potential. However, realizing a significant portion of this potential requires understanding not only the technical factors affecting the decision to use these systems, but also the relevant regulatory, economic, attitudinal, and market development factors. If a significant portion of this market potential is captured, gas sales will increase and the penetration of

coal technologies into those market sectors traditionally served by gas will be slowed.

6116 **Energy requirements in mining.** Granville, A. (Department of Mineral and Energy Affairs, Johannesburg (South Africa). Minerals Bureau). pp 50-60 of South African energy in perspective: Proceedings Pt. 1. A conference organised by SANCWEC at CSIR Conference Centre, Pretoria, 24-25 Jan 1983. Cape Town, South Africa; South African National Committee (1983). (CONF-830150—Pt.1).

From Conference on South African energy in perspective; Pretoria, South Africa (24 Jan 1983).

In this article the following items are discussed: 1) A forecast of energy demand by the mining industry to the year 2008. 2) A breakdown by mining sectors and fuel types. 3) The effect on mining operations of fuel availability and fuel cost. 4) The potential for energy conservation. 5) The possible use of discard coal. 6) Potential developments in mining techniques which could affect energy use.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 6033, 6081, 6104, 6113, 6115

6117 **(AD-A—131254/5) Preliminary operating assessment advanced heat recovery incinerator (HRI). Site one. O'Connor Combustor Corporation. Final report for period ending January 1983.** Hollander, H.I.; Matzuk, G.J.; Romine, G. (Sanders and Thomas, Inc., Pottstown, PA (USA)). Jul 1983. 35p. NTIS, PC A03/MF A01.

This brief evaluation of the first O'Connor (rotary water-well) Combustor plant built in the U.S.A. describes design features and considerations as well as initial operating advantages and difficulties. A brief general description of a co-located, proprietary fuel preparation system is included. The major conclusion presented alludes to a waste fuel availability requirement approaching 60 tons per day (tpd) for probable cost-effectiveness of this technology.

6118 **(ANL/CNSV-TM—120-Vol.3) Thermal systems for conversion of municipal solid waste. Volume 3. Small-scale systems: a technology status report.** Hopper, R. (Battelle Columbus Labs., OH (USA)). Jul 1983. Contract W-31-109-ENG-38. 162p. NTIS, PC A08/MF A01. Order Number DE84003663.

Detailed technical, economic, and environmental data about small-scale municipal waste-to-energy systems in the United States are presented. Together, these data constitute a comprehensive decision-making guide for communities, industrial firms, consultants, and others studying the feasibility of such systems or involved in their planning and implementation. In particular, the study describes several representative operating systems.

6119 **(ANL/CNSV-TM—120-Vol.5) Thermal systems for conversion of municipal solid waste. Volume 5. Pyrolytic conversion: a technology status report.** Kuester, J.L. (Argonne National Lab., IL (USA)). Jun 1983. Contract W-31-109-ENG-38. 96p. NTIS, PC A05/MF A01. Order Number DE84003664.

This report reviews the state of the art of pyrolytic technologies as applied to municipal-waste feedstocks. Included in the discussion are those pure-pyrolysis and incomplete-combustion processes that produce either a final product or a synthesis gas for further processing. The feedstock resource base is reviewed, and possible options for utilizing the feedstock base for energy production are described. Following a review of fundamental concepts about pyrolysis, descriptions and evalutions of both present and emerging technologies are presented.

6120 **(DOE/R6/11999—T1) Put paper in its place. Arkansas state offices waste paper recycling project. Final report.** (Arkansas State Government, Little Rock (USA)). [nd]. Contract FG46-80R611999. 22p. NTIS, PC A02/MF A01. Order Number DE84003538.

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The development and implementation of a waste paper recycling program that would involve state personnel and property, enabling the program to be closely monitored and managed, are described. Collection schedules, invitation to bid, and contract with the paper buyer are attached. (MHP)

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 6093, 6130

6121 **(CONF-831174—43) Status, needs, and opportunities for structural ceramics in advanced heat engines.** Tennery, V.J. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 12p. NTIS, PC A02/MF A01. Order Number DE84003307.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

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The potential for using structural ceramic materials in components of advanced heat engines including the gas turbine and adiabatic diesel has recently been demonstrated by results in DOE and DOD engine development programs. Status of these efforts, technical needs for candidate ceramic materials, and research opportunities in new DOE and NASA ceramic technology programs oriented to heat engines are reviewed.

6122 **(DOE/CE—0027/2) Fifth annual report to Congress on the Automotive Technology Development Program.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Office of Vehicle and Engine Research and Development). Dec 1983. 22p. NTIS, PC A02/MF A01. Order Number DE84004097.

Progress is reported on the status of conventional powertrain technology and R and D projects that address the high risk areas associated with the gas turbine engines, Stirling engine, heavy duty transport technology, and ceramic materials technology development. (MHR)

6123 **(DOE/RL/01830—T11) Fabrication and coating of selected diesel engine components for combustion durability testing. Final technical report.** Stiglich, J.J. Jr. (San Fernando Labs., Pacoima, CA (USA)). Sep 1983. Contract AC06-76RL01830. 76p. NTIS, PC A05/MF A01. Order Number DE84002188.

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This report describes efforts to fabricate coated ceramic components for testing in advanced diesel engines. Four facilities contributed to this project: San Fernando Laboratories, University of Missouri (Rolla), Eagle Picher Miami Research Laboratories, and GTE WESGO. Miami Research Laboratories developed slip cast and sintered mullite and zirconia parts for valves and pistons. The University of Missouri (Rolla) measured thermal expansion properties of various zirconia compositions worked on by Miami Research Laboratories. San Fernando Laboratories developed SiC coating techniques for materials provided by Miami Research Laboratories. In addition, hard/erosion resistant coatings were applied to fuel injector parts in a demonstration, feasibility study. GTE WESGO developed brazing techniques for attachment of ceramic parts to valves and pistons.

6124 **(DOE/RL/01830—T12) CNTD SiC overcoat development on thermal barriers. Final technical report.** Stiglich, J.J. Jr. (San Fernando Labs., Pacoima, CA (USA)). Sep 1983. Contract AC06-76RL01830. 27p. NTIS, PC A03/MF A01. Order Number DE84002186.

Attempts to deposit coatings of ultra-fine grained SiC onto ZrO_2 based thermal barrier coatings are described. The purpose is to seal the ZrO_2 surface against penetration by reactive impurity species present in dirty fuels as represented by certain synthetic fuels. Chemical vapor deposition techniques were used to deposit a proprietary fine grained SiC coating onto ZrO_2 thermal barrier specimens obtained from various sources. The process is termed CNTD - Controlled Nucleation Thermochemical Deposition. Al-

though a dense SiC coating was successfully applied to sintered ZrO_2, efforts to coat thermal barriers which had been plasma sprayed or sputtered were unsuccessful. In a series of ancillary experiments San Fernando Laboratories fine grained SiC (called CM 4000) was characterized for its erosion resistance and oxidation/corrosion resistance.

6125 **(EUR—7660-EN) Survey of the technological requirements for high-temperature materials R + D. Section 1.** Timoney, S.G. (Commission of the European Communities, Petten (Netherlands). Joint Nuclear Research Center). 1983. 60p. Commission of the European Communities, Luxembourg.

This survey is intended to accelerate the growth of awareness among materials technologists and Diesel engine designers of the need for a more ambitious programme of research, directed at developing engines to run at much higher temperatures than they do at present. Much progress has been made in high temperature materials technology with reference to gas turbines, nuclear power systems and chemical process plant, but Diesel engine designers are not adequately aware of this. Similarly Diesel engine design has made great progress with improvement of combustion control, of supercharging and, (by use of finite element stress analysis techniques) of the detail of component shapes. It is hoped by the authors that this survey will be placed in the hands of both materials technologists and engine designers and that it will act as a catalyst to encourage constructive discussion between them.

3302 External Combustion Engines

REFER ALSO TO CITATION(S) 6122

6126 **(ANL-CT—83-7-Pt.1) Free-piston Stirling engine experimental program: Part 1. Baseline test summary.** Berggren, R.; Moynihan, T. (Mechanical Technology, Inc., Latham, NY (USA)). Jun 1983. Contract W-31-109-ENG-38. 51p. NTIS, PC A04/MF A01. Order Number DE84003659.

Free-Piston Stirling Engine experimental data are presented from a series of tests that establish the operating characteristics of the engine and determine performance repeatability. The operating envelope of the engine was to determine maximum parameter range and repeatability. Tests were then carried out in which individual operating parameters were varied while others were maintained constant. These data establish the baseline operation of the engine as a preliminary to a series of tests in which several suspected sources of energy loss are investigated by changing the engine geometry to isolate and magnify each suspected loss mechanism. Performance with the geometry change is compared against baseline operation to quantify the magnitude of the loss mechanism under investigation. The results of the loss mechanism investigation are presented in Part 2 of this report.

6127 **(ANL-CT—83-7-Pt.2) Free-piston Stirling engine experimental program: Part 2. An evaluation of loss mechanisms.** Moynihan, T.; Berggren, R.; Dochat, G. (Mechanical Technology, Inc., Latham, NY (USA)). Jun 1983. Contract W-31-109-ENG-38. 189p. NTIS, PC A09/MF A01. Order Number DE84003658.

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A series of experiments is described in which measurements were taken on a free-piston Stirling engine to isolate effects believed to degrade engine performance. The effects examined were: compression-space hysteresis, regenerator losses, displacer seal clearance loss, and displacer appendix gap loss. The experimental data from these experiments are given and represent a valuable resource for validation of Stirling engine analysis methods. The most significant of the above effects was found to be the clearance between the displacer and cylinder wall. Best performance was attained by a close clearance seal of 2 mils. Greater clearances or use of a piston ring degraded performance. Overall efficiency of the engine was raised several points due to this finding.

3304 Hybrid Systems

6128 **(NP—4770053) Optimising the operational parameters of a hybrid bus drive in order to minimize fuel consumption.** Regar, K.N. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 29 Oct 1981. 246p. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84770053.

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Regenerative braking in vehicles which are operated mainly in transient state offers the basic possibility of reducing the fuel consumption. Vehicles developed for that purpose have not fulfilled these hopes, some of them even show a higher fuel consumption. This study shows that fuel can only be saved if: - the efficiency degree of regenerative braking is at its highest - the efficiency degree of energy conversion and -transmission from the fuel tank to the driving axle is improved or at least not worse than that of a conventional driving system - control of energy flows within the system is optimised by means of an adequate operational strategy. Application of these principles in conceiving a hybrid drive system for public transport city buses lead to considerable fuel saving of 22% in test runs. Acceleration, driving comfort, exhaust gas- and noise emission were clearly improved.

3305 Flywheel Propulsion

REFER ALSO TO CITATION(S) 6128

3307 Emission Control

REFER ALSO TO CITATION(S) 6594

6129 **(DOE/PE/70045—T17) Subtask 1 report: emission control system identification. Task 25.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). 22 Oct 1982. Contract AC01-78PE70045. 62p. NTIS, PC A04/MF A01. Order Number DE84003932.

The emphasis here is the identification of emission control systems through information contained in the vehicle identification number (VIN). The data base which maps each combination of carline and engine symbol into the possible engine families is described in detail. The methods used in developing this data base are summarized. The instances in which major features of the emission control system can not be determined unambiguously from the VIN are identified. Recommendations are presented for resolving the ambiguities with the assistance of auto manufacturers. The ability of the several manufacturers to assist in further decoding of VINs and is reported and the information presently available on costs of doing so is provided. Data files that will be used to extract manufacturer, carline, and engine symbols from VINs and then access the master VIN/engine family data base are listed. The master data base is listed in its entirety. The cases of ambiguous emission control identification are listed. (MHR)

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 5836

6130 **(DOE/BETC/RI—83/12) Emissions and efficiency of agricultural diesels using low-proof ethanol as supplement fuel.** Allsup, J.R.; Clingenpeel, J.M. (USDOE Bartlesville Energy Technology Center, OK). Jan 1984. 26p. NTIS, PC A03/MF A01. Order Number DE84003931.

Experimental investigations were made to evaluate the potential of using low-proof ethanol to supplement diesel fuel in agricultural engines. Fumigation, mechanical emulsification, and chemical emulsifiers were used to introduce a significant amount of alcohol with diesel fuel for engine operation. A total of five diesel tractor engines were tested using each of the fuel systems. Exhaust products and fuel usage were determined at various engine speed/load conditions. 5 references, 12 figures, 14 tables.

6131 **(DOE/R6/12068—T1) Development of a multi-resource alternate energy facility (addition of dual-fuel). Final technical report.** Keel, J.S. (Keel (James S.), Harrison, AR (USA)). 3 Nov 1982. Contract FG46-81R612068. 18p. NTIS, PC A02/MF A01. Order Number DE84003432.

This report describes the use of compressed natural gas (methane) in a dual fuel 1979 Jeep pick-up truck. Descriptions of the compressor and the dual-fuel conversion equipment are attached. (DMC)

36 MATERIALS

REFER ALSO TO CITATION(S) 5677

6132 **(DOE/S—0027) Materials research and development.** (USDOE Office of Energy Research, Washington, DC. Energy Research Advisory Board). Nov 1983. 35p. NTIS, PC A03/MF A01. Order Number DE84003710.

The principal findings of the Panel relate to (1) the need for a stronger focus within the energy technology offices and the delegation of broader responsibilities to the nondefense energy laboratories, and (2) the need for a technology development program to bridge the gap between materials research funded by Basic Energy Sciences and materials engineering funded by the applied technology divisions. Topics discussed in the report are: the basic materials research roles of DOE and the proper balance among roles and performers; the portion of DOE basic materials science budget that should be allocated to the development and support of major facilities; responsibilities assigned to nondefence laboratories; gaps in the program; and incorporation of results into energy developments. (MCG)

6133 **Microstructure development during final/intermediate stage sintering. II. Grain and pore coarsening.** Spears, M.A.; Evans, A.G. (Univ. of California, Berkeley). *Acta Metallurgica;* **30**: 1281-1289(1982). Contract W-7405-ENG-48.

The rates of grain and pore coarsening and of pore shrinkage that occur during sintering have been analyzed in the presence of porosity at three-grain junctions. Optimum sintering conditions that exclude pore coarsening have been identified. The pore coarsening that occurs under sub-optimal sintering conditions depends on the dominant diffusivities, the grain boundary mobility and the dihedral angle. The pore sizes that develop during sintering have been compared with the critical pore size for pore-grain boundary breakaway, and conditions for averting breakaway discussed.

6134 **Microstructure development during final/intermediate stage sintering. I. Pore/grain boundary separation.** Hsueh, C.H. (Lawrence Berkeley Lab., CA); Evans, A.G.; Coble, R.L. *Acta Metallurgica;* **30**: 1269-1279(1982). Contract W-7405-ENG-48.

The motion of pores attached to two grain interfaces has been analyzed. It is shown that pores exhibit a maximum steady state velocity that varies with the dihedral angle and that the onset of nonsteady state pore motion results in grain boundary convergence and the separation of the pore from the grain boundary. The peak steady pore velocity has been compared with grain boundary velocities for several grain configurations, in order to identify a critical condition for the onset of separation. This comparison indicates that the pore size must be maintained below a critical value to ensure attachment.

6135 **Studies of the melting of a 2D solid.** Sinha, S.K. (Argonne National Lab., IL); Vora, P.; Dutta, P.; Passell, L. *Journal of Physics C: Solid State Physics;* **15**: L275-L281(1982).

We have made a detailed numerical analysis of neutron diffraction lineshapes across the constant-coverage melting transition of incommensurate monolayers of methane on graphite. We find that in the liquid phase the liquid lineshape is well fitted with a Lorentzian structure factor. While the exact nature of the transition very close to T/sub m/ cannot be commented upon, the freezing of the liquid appears to be initially continuous, with an increase in correlation length to hundreds of Angstroms before the appearance of a solid phase.

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 5846, 5918, 5918, 5939, 6039, 6048, 6268, 6568, 6803

6136 **(BDX—613-3001) Over-aging of aluminum alloys. Final report.** Ulitchny, M.G. (Bendix Corp., Kansas City, MO (USA)). Dec 1983. Contract AC04-76DP00613. 15p. NTIS, PC A02/MF A01. Order Number DE84004927.

The effects of short-time over-aging on the mechanical properties of aluminum alloys 7050-T736, 7075-T6, 9021-T4, and 9052-F have been evaluated. Test results show that when subjected to a temperature of 600°F for short periods of time, the 7XXX series alloys lose almost all of the tensile strength they received through heat treatment; alloy 9021-T4 loses less of its strength; and 9052-F loses almost none of its strength. Tensile tests carried out on 7050-T736 and 7075-T6 in both the as-received and stress-relief-annealed conditions have confirmed that the stress relief anneal has little or no effect on tensile strength.

6137 **(CONF-791134—14) Ideal thermal conductivity of Pd and Nb.** Pinski, F.J.; Butler, W.H.; Allen, P.B. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 12p. NTIS, PC A02/MF A01. Order Number DE84003375.

From 16. international thermal conductivity conference and 7. thermal expansion conference; Chicago, IL, USA (7 Nov 1979). Portions are illegible in microfiche products.

We have calculated the electron-phonon contribution to the thermal conductivity of Pd and Nb. The Boltzmann equation describes the electronic distribution function in the presence of a thermal gradient. We solved the Boltzmann equation within the rigid-muffin-tin approximation, using a very dense mesh of first-principles, Korringa-Kohn-Rostoker wave vectors on the Fermi surface. Phonon frequencies and polarizations were obtained from Born-von Karman force-constant fits of neutron scattering data. The electron-phonon matrix elements were calculated by using the rigid-muffin-tim approximation. Our calculation is free of adjustable parameters. Agreement with experiment is at the 15% level at room temperature. 18 references, 2 figures.

6138 **(CONF-830659—16) Development of modified 9 Cr-1 Mo steel for elevated-temperature service.** Sikka, V.K. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 11p. NTIS, PC A02/MF A01. Order Number DE84003161.

From TMS/AIME topical conference on ferritic alloys for use in nuclear energy technologies; Snowbird, UT, USA (19 Jun 1983).

The status of development and commercialization of a modified 9 Cr-1 Mo alloy is presented. The alloy is modified by the addition of 0.06 to 0.10% Nb and 0.18 to 0.25% V. The alloy is recommended for use in the normalized and tempered condition (1040°C for 1 h, air cooled to room temperature; 760°C for 1 h, air cooled to room temperature). Heat treatment, Charpy impact, tensile, and creep properties of the alloy are described in detail along with a brief description of other properties. The modified alloy has creep strength that exceeds that of standard 9 Cr-1 Mo and 2 1/4 Cr-1 Mo steels for the temperature range from 427 to 704°C. The total-elongation and reduction-of-area values for all test temperatures and rupture times up to 22,500 h exceed 15 and 70%, respectively. The estimated design allowable stresses for this alloy are higher than those for standard 9 Cr-1 Mo and 2 1/4 Cr-1 Mo steel. At 550°C and above, these values are twice those of the other alloys. Operating experience on this alloy is being obtained by installing tubes in various steam power plants. 13 figures, 5 tables.

6139 **(CONF-830659—17) Swelling behavior of a simple ferritic alloy.** Horton, L.L.; Bentley, J. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 10p. NTIS, PC A02/MF A01. Order Number DE84003162.

From TMS/AIME topical conference on ferritic alloys for use in nuclear energy technologies; Snowbird, UT, USA (19 Jun 1983).

The swelling behavior which results from simulated fusion environment irradiation of Fe-10% Cr has been characterized with transmission electron microscopy. Specimens were bombarded at 850 K with: a triple-beam of He^+, D^+_3, and 4 MeV Fe^{++} ions to 0.3, 1, 3, 10, 30, and 100 dpa, a dual-beam of He^+ and 4 MeV Fe^{++} ions to 30 and 100 dpa; and a single-beam of 4 MeV Fe^{++} ions to 30 dpa. The helium and hydrogen injection rates were ~ 10 appm He/dpa and ~ 40 appm D/dpa. Cavities were observed for damage levels of 3 dpa and greater. The swelling was <0.1% for damage levels <30 dpa, but at 100 dpa, there was an increase in the swelling to 2.5% for the triple-beam irradiation and 1.2% for the dual-beam irradiation. The swelling rates between 30 and 100 dpa correlate well with calculated values assuming a steady-state swelling-rate regime has been reached. Calculations show the rapid cavity growth associated with this swelling increase cannot be attributed to equilibrium bubble growth. For all of the bombardments, the cavities with a diameter greater than 10 nm had a truncated octahedral morphology with (111) facets and (100) truncations. Measurements indicate that the surface energy relationship was $\gamma_{111} \cong 0.8\ \gamma_{100}$ for these cavities. At 30 dpa, the cavities in the specimen irradiated with the single-beam technique were larger and had a lower concentration than the specimens irradiated with specimens irradiated with the dual- and triple-ion beams suggests that deuterium has an effect on the damage microstructures in Fe-10% Cr.

6140 **(CONF-830888—11) Amorphous zirconium-nickel films formed by solid state reactions.** Clemens, B.M.; Johnson, W.L.; Schwarz, R.B. (Argonne National Lab., IL (USA); General Motors Research Labs., Warren, MI (USA); California Inst. of Tech., Pasadena (USA)). Sep 1983. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01. Order Number DE84003570.

From 5. international conference on liquid and amorphous metals; Los Angeles, CA, USA (15 Aug 1983).

We have formed an amorphous zirconium-nickel phase by annealing vapor deposited crystalline layers of elemental zirconium and nickel. Auger depth profiling and x-ray diffraction have been used to monitor the reaction. The thermodynamics of the process is explained in terms of a metastable free energy diagram which reflects the large negative heat of mixing between zirconium and nickel. The formation of an amorphous layer occurs via a diffusion limited reaction occurring at the zirconium-nickel interface.

6141 **(CONF-830888—12) Study of amorphous alloys of Au with Group III A elements (Y and La) formed by a solid-state diffusion reactor.** Schwarz, R.B.; Wong, K.L.; Johnson, W.L.; Clemens, B.M. (California Inst. of Tech., Pasadena (USA); Argonne National Lab., IL (USA); General Motors Research Labs., Warren, MI (USA)). Sep 1983. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01. Order Number DE84003572.

From 5. international conference on liquid and amorphous metals; Los Angeles, CA, USA (15 Aug 1983).

Amorphous alloys Au/sub x/M/sub 1-x/, with $x \cong 0.5$, where M is La or Y, have been formed through solid-state interdiffusion reaction of pure polycrystalline Au, La, and Y thin films (200 to 600 A thickness) at temperatures of 50 to 130 C. For $x \geqq 0.7$ the end product of the reaction is a two-phase material containing polycrystalline Au and amorphous Au-M, while for $x \leqq 0.3$ the end product is amorphous Au-M plus polycrystalline M. The attainment of these products is explained in terms of the common tangent rule applied to the Gibbs free energy diagram of the amorphous allloy and the crystalline compounds observed.

6142 **(CONF-830942—62) Effect of specimen size and nickel content on the impact properties of 12 Cr-1 MoVW ferritic steel.** Corwin, W.R.; Klueh, R.L.; Vitek, J.M. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE84003270.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

The ferritic steel 12 Cr-1 MoVW is a candidate material for use in the first wall of magnetic fusion reactors. One of the primary concerns of materials in this application is service-induced embrittlement from aging and irradiation. Unirradiated Charpy impact data have been developed on three typical heats of 12 Cr-1 MoVW steel and on heats that have been modified with nickel and chromium additions for subsequent simulation of helium effects of irradiation. The ductile-to-brittle transition temperature and the upper-shelf energy were reduced by nickel additions. The addition of nickel while simultaneously maintaining a constant net chromium equivalent caused the transition temperature to increase. The use of a subsize specimen is mandated by the small volume and high gamma heating in high-flux research reactors used for very high-fluence irradiation experiments. Therefore, an understanding of the behavior of the subsize specimen is important in predicting corresponding irradiation-induced transition temperature shifts and upper-shelf drops of full-size Charpy specimens. Data are reported from subsize Charpy impact specimens, and the full- and subsize specimens are compared. The effect of specimen size on the upper-shelf energy of this material can be reduced better by volume normalization than by area normalization.

6143 **(CONF-830942—63) Temperature aspects of pulsed ion bombardment in an austenitic alloy.** Packan, N.H. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 7p. NTIS, PC A02/MF A01. Order Number DE84003382.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

The influence of pulsed ion irradiation to a damage level of 10 dpa at temperatures from 843 to 1023°K has been studied in a quaternary Fe-17Cr-17Ni-2.5Mo austenitic alloy. Pulsing periods of either 60 s on/60 s off or 1 s on/1 s off were used, together with continuous bombardment as a control. Helium (200 appM) was supplied either by simultaneous or room temperature preimplantation, or omitted. While most specimens experienced only 2 to 3°K temperature fluctuations with the beam pulses, certain specimens were deliberately allowed to undergo 15 to 50°K variations. Pulsed irradiation effects were found to range from little effect at 843°K, through a notable modification in the relationship between helium and cavity parameters at 938°K (near the peak swelling temperature), to a substantial reduction of swelling at 1023°K. The influence of the simultaneous temperature excursions compared with constant-temperature pulsed ion bombardment (mostly compared at 843°K) was small. These results are interpreted in terms of the effects of pulsing and helium on the stability of cavities at high temperatures through the critical size and number of gas atoms needed for a small cavity to begin bias-driven void growth.

6144 **(CONF-830942—65) Improved swelling resistance for PCA austenitic stainless steel under HFIR irradiation through microstructural control.** Maziasz, P.J.; Braski, D.N. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 7p. NTIS, PC A02/MF A01. Order Number DE84003203.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

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Six microstructural variants of Prime Candidate Alloy (PCA) were evaluated for swelling resistance during HFIR irradiation, together with several heats of type 316 stainless steel (316). Swelling was negligible in all the steels at 300°C after ~ 44 dpa. At 500 to 600°C 25%-cold-worked PCA showed better void swelling resistance than type 316 at ~ 44 dpa. There was less swelling variability among alloys at 400°C, but again 25%-cold-worked PCA was the best. Microstructurally, swelling resistance correlated with development of fine, stable bubbles whereas high swelling was due to coarser distributions of bubbles becoming unstable and converting to voids (bias-driven cavities).

6145 **(CONF-830942—67) Effects of pulsed and/or dual ion irradiation on microstructural evolution in a Ti and Si modified austenitic alloy.** Hishinuma, A.; Packan, N.H.; Lee, E.H.; Mansur, L.K. (Japan Atomic Energy Research Inst., Tokai, Ibaraki; Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE84003411.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

The influence of pulsed 4 MeV Ni-ion bombardment, with and without simultaneous helium injection, at 958 K and damage levels from 1 to 50 dpa has been studied in a low swelling, Ti- and Si- modified austenitic stainless steel. Compared to continuous irradiation, pulsing caused an increase in the number density of interstitial loops formed during irradiation. Helium also increased the nucleation of interstitial loops. The main precipitates formed were a large number of small TiC particles uniformly distributed in the matrix, and a small number of relatively large eta and G precipitates. These course precipitates were somewhat larger in the pulsed specimens. Pulsing appeared to produce no significant change in swelling compared to continuous irradiation. However, for one specimen irradiated to 54 dpa, pulsing concurrent with substantial temperature fluctuations caused by beam heating may have been responsible for a larger swelling compared to continuous irradiation.

6146 **(CONF-830942—70) Corrosion and oxidation of vanadium-base alloys.** Loomis, B.A.; Wiggins, G. (Argonne National Lab., IL (USA)). Oct 1983. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01. Order Number DE84003266.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

The corrosion of several V-base alloys on exposure at elevated temperatures to helium environments containing hydrogen and/or water vapor are presented. These results are utilized to discuss the consequences of the selection of certain radiation-damage resistant, V-base alloys for structural materials applications in a fusion reactor.

6147 **(CONF-831174—40) Study of ion bombardment-induced subsurface compositional modifications in Ni-Cu alloys at elevated temperatures by ion scattering spectroscopy.** Lam, N.Q.; Hoff, H.A.; Wiedersich, H.; Rehn, L.E. (Argonne National Lab., IL (USA)). Oct 1983. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01. Order Number DE84003632.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

Changes in the subsurface composition of Ni-40 at.% Cu alloys during 3-keV Ne^+ bombardment at temperatures between 25 and 700°C were studied by means of ion scattering spectroscopy. Both the time evolution of the composition in the surface atom layer during ion bombardment and subsurface concentration profiles after rapid specimen cooling to room temperature were measured as a function of temperature. Radiation-enhanced diffusion coefficients were derived from the effective altered-layer thicknesses obtained. A comparison of the experimental measurements with theoretical calculations based on a phenomenological model enabled the identification of processes and kinetics responsible for subsurface compositional modifications.

6148 **(CONF-831174—44) Segregation of Zn solutes to high-angle (001) twist grain boundaries in Al.** Wolf, D.; Lam, N.Q. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 9p. NTIS, PC A02/MF A01. Order Number DE84003455.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

The energies of the $\Sigma = 5$, 13, and 17 (001) coincident-site lattice (CSL) twist boundaries in Al containing small amounts of Zn solutes have been calculated using an iterative energy minimization technique in conjunction with interatomic potentials derived entirely from first principles. By determining both the energies of substitution in the bulk and in different sites in the boundary, the site selectivity for Zn segregation at the grain boundary has been investigated. In the lattice plane immediately near the grain boundary, Zn solutes were found to prefer the lower-symmetry non-coincidence sites while, in the next plane, substitution in the coincidence sites is preferred. The effect of Zn-Zn interactions has also been considered for small solute concentrations. It is found that the magnitude of the Zn-Zn interaction energy is remarkably insensitive to the particular sites occupied by the Zn atoms as well as the detailed geometry of the interface.

6149 **(CONF-831174—45) Dependence of ion beam mixing on projectile mass.** Averback, R.S.; Thompson, L.J.; Rehn, L.E. (Argonne National Lab., IL (USA)). Nov 1983. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01. Order Number DE84004020.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

Ion beam mixing in Pt-Si bilayered samples was measured during irradiation with projectiles ranging in mass from 4 amu (He) to 131 amu (Xe) at 10°K, 300°K and 373°K. Using deposited damage energy as a basis for comparing the different irradiations, it was found that the heavier ions were more efficient than the lighter ones for inducing mixing. Moreover, it was observed that the mixing was essentially independent of temperature below 373°K. These results are interpreted on the basis that the mixing is caused by the stimulated motion of defects during the cooling phase of energetic cascades.

6150 **(CONF-8310198—3) Mechanical properties of types 304 and 316 stainless steel after long-term aging and exposure.** Horak, J.A.; Sikka, V.K.; Raske, D.T. (Oak Ridge National Lab., TN (USA); Argonne National Lab., IL (USA)). 1983. Contract W-7405-ENG-26. 35p. NTIS, PC A03/MF A01. Order Number DE84003325.

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

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Because designs for Liquid Metal Fast Breeder Reactor (LMFBR) power plants include plant lifetimes to 40 years, an understanding of the mechanical behavior of the structural alloys used is required for times of $\sim$ 2 to 2.5 x 10^5 h. Most of the alloys used for LMFBR out-of-core structures and components are in a metastable state at the beginning of plant lifetime and evolve to a more stable state and, therefore, microstructure during plant operation. We reviewed mechanical properties and microstructures after prolonged elevated-temperature exposure of types 304 and 316 stainless steel, two alloys used extensively in fast breeder systems. Aging alters properties; in particular, it decreases toughness and tensile ductility, but the properties are still adequate for service. Because stable microstructures have been reached in long-term exposures achieved so far, properties can be expected to remain adequate for service life exposures.

6151 **(CONF-8310198—4) Effects of sodium environment on the mechanical properties of Fe-2 1/4Cr-1Mo steel.** Chopra, O,K. (Argonne National Lab., IL (USA)). Sep 1983. Contract W-31-109-ENG-38. 14p. NTIS, PC A02/MF A01. Order Number DE84003611.

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

Mechanical property data on isothermally annealed, thermally aged, and sodium-exposed Fe-2 1/4Cr-1Mo steel are analyzed to evaluate the influence of the sodium environment as well as the effects of the microstructural and compositional changes that occur in the steel during long-term exposure to sodium. Correlations are developed to predict the environmental effects on tensile, creep, fatigue, and creep-fatigue properties of Fe-2 1/4Cr-1Mo steel in sodium. The results indicate that at temperatures < 823 K (550°C), degradation of mechanical properties is essentially due to thermal aging. Loss of carbon from the steel reduces both the tensile and creep-rupture strength, but has little or no effect on the fatigue properties. The cyclic properties of Fe-2 1/4Cr-1Mo steel in sodium are superior to those in air. The creep-fatigue behavior in sodium is significantly different from that in an air environment. The creep-fatigue data are analyzed using the interactive damage rate equations to predict the time-dependent fatigue behavior of isothermally annealed Fe-2 1/4Cr-1Mo steel in sodium. 15 references, 7 figures, 1 table.

6152 **(DOE/ER/10942—3) Studies on age-hardening in spinodally modulated alloys: experimental and theoretical. Progress report, May 1, 1983-April 30, 1984.** (Michigan State Univ., East Lansing (USA)). Dec 1983. Contract AC02-81ER10942. 125p. NTIS, PC A06/MF A01. Order Number DE84004650.

Dislocations in deformed as-quenched and aged Cu-10Ni-Sn alloy were analyzed by TEM. Burgers vector analysis indicated that deformation of as-quenched specimens occurred predominantly by edge and screw dislocations, while mixed dislocations are mainly responsible for deformation of aged specimens. In-situ straining of Cu-10Ni-6Sn in HVEM provided information on dislocation behavior in the modulated structure. Video recording was conducted on the dislocation shape during deformation, dislocation velocity and the mode of slip propagation. Fracture of this alloy seems to occur by void coalescence in front of the opening crack. Theoretical studies dealt with developing models for dislocation behavior in alloys that have undergone later stages of decomposition. The role of wave-squaring of the internal stress field on critical resolved shear stress (CRSS) was analyzed.

6153 **(DP-MS—82-90) Hydrogen effects in stainless steel.** Caskey, G.R. Jr. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1983. Contract AC09-76SR00001. 87p. NTIS, PC A05/MF A01. Order Number DE84003483.

The effects of hydrogen on stainless steels have been reviewed and are summarized in this paper. Discussion covers hydrogen solution and transport in stainless steels as well as the effects of hydrogen on deformation and fracture under various loading conditions. Damage is caused also by helium that arises from decay of the hydrogen isotope tritium. Austenitic, ferritic, martensite, and precipitation-hardenable stainless steels are included in the discussion. 200 references.

6154 **(HEDL-SA—2793-FP) Ductility and microstructure of precipitation-strengthened alloys irradiated in HFIR.** Yang, W.J.S.; Hamilton, M.L. (Hanford Engineering Development Lab., Richland, WA (USA)). Aug 1983. Contract AC06-76FF02170. 7p. (CONF-830942—64). NTIS, PC A02/MF A01. Order Number DE84003790.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

Six γ' and γ'/γ'' strengthened Ni-base alloys have shown near-zero ductility after irradiation at 300 to 600°C in HFIR to a peak exposure of 9 dpa. Microstructural examination of the irradiated specimens showed that the loss of ductility in these alloys arises from the simultaneous existence of a strong matrix and weak grain boundaries. The strong matrix is attributed to the irradiation-induced γ' and γ'/γ'' precipitates, the faulted loops and a high density of fine helium bubbles. The weak grain boundaries are attributed to the formation of an unfavorable precipitate, such as eta-plates, recrystallized grains, a thin layer of γ' and helium bubbles.

6155 **(HEDL-SA—2897) Correlation of fracture toughness with tensile properties for irradiated 20% cold-worked 316 stainless steel.** Hamilton, M.L.; Garner, F.A.; Wolfer, W.G. (Hanford Engineering Development Lab., Richland, WA (USA); Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering). Aug 1983. Contract AC06-76FF02170. 6p. (CONF-830942—68). NTIS, PC A02/MF A01. Order Number DE84003954.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

A correlation has been developed which allows an estimate to be made of the toughness of austenitic alloys using more easily obtained tensile data. Tensile properties measured on 20% cold-worked AISI 316 specimens made from ducts and cladding irradiated in EBR-II were used to predict values for the plane strain fracture toughness according to a model originally developed by Krafft. Some microstructural examination is required to determine a parameter designated as the process zone size. In contrast to the frequently employed Hahn-Rosenfeld model, this model gives results which agree with recent experimental determinations of toughness performed in the transgranular failure regime.

6156 **(INIS-BR—62) Niobium thermal - mechanical treatment produced by continuously cast ingots and electron beam fusion.** Santos, H.M. dos; Rodrigues, J.A.; Pinatti, Dyonisio G. (Sao Carlos Univ. (Brazil). Dept. de Engenharia de Materiais). 1980. 11p. (In Portuguese). (CONF-8012116—2). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703933.

From 4. Brazilian congress on materials science and engineering; Camboriu, Brazil (15 Dec 1980).

Continuonsly cast Nb ingots produced in Brazil by electron beam fusion have been thermally-mechanically processed. These ingots were subjected to a pre-deformation between 0 to 50%, and subsequently treated thermally between 900 to 1800°C for 2,3 and 4 hours. Grain refinement was attained by further reduction in area deformations between 42 to 96%, followed by thermal treatments for 3 hours between 810 to 1300°C. The results material exhibited an equiaxial grain structure of 50 μm and was tensile tested. These tensile results are compared to the results for niobium produced by traditional commercial practices. (Author).

6157 **(INIS-BR—63) Ion nitridation - physical and technological aspects.** Elbern, A.W. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Dept. de Engenharia Nuclear). 1980. 12p. (In Portuguese). (CONF-8012116—3). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703934.

From 4. Brazilian congress on materials science and engineering; Camboriu, Brazil (15 Dec 1980).

Ion nitridation, is a technique which allows the formation of a controlled thickness of nitrides in the surface of the material, using this material as the cathode in a low pressure glow discharge, which presents many advantages over the conventional method. A brief review of the ion nitriding technique, the physical phenomena involved, and we discuss technological aspects of this method, are presented. (Author).

6158 **(INIS-BR—64) Determination of lower bound crystallographic yield loci of zircaloy-4 tubes.** Costa Viana, C.S. da; Brito Costa, H. de. (Rio de Janeiro Univ. (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia). 1980. 8p. (In Portuguese). (CONF-8012116—4). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703935.

From 4. Brazilian congress on materials science and engineering; Camboriu, Brazil (15 Dec 1980).

The use of zircaloy-4 tubing in fuel elements of water cooled reactors is discussed with respect to its mechanisms of deformation and also its resulting anisotropic plastic behaviour. A method for obtaining lower bound crystallographic yield loci of α-Zr is presented and applied to individual crystal orientations and to a real texture described by the main components observed on a direct pole figure. (Author).

6159 **(INIS-BR—65) Mechanical behavior of Zircaloy-4 tubes under complexe state of stress.** Costa Viana, C.S. da; Brito Costa, H. de. (Rio de Janeiro Univ. (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia). 1980. 7p. (In Portuguese). (CONF-8012116—16). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704621.

From 4. Brazilian congress on materials science and engineering; Camboriu, Brazil (15 Dec 1980).

The use of zircaloy-4 tubing as cladding material for fuel elements is reviewed with respect to its microstructural, textural and loading conditions. Its anisotropic plastic behaviour is studied through the experimental determination of its yield locus by mechanical testing and Knoop hardness and compared to Hill's anisotropic yield criterion.

6160 **(INIS-BR—66) Electrical resistivity of Nb - 2,5% Zr alloy in He atmospheres with and without neutronic radiation.** Otero, M.P.; Lucki, G. (Instituto de Energia Atomica, Sao Paulo (Brazil). Centro de Aplicacao de Radioisotopos e Radiacao na Engenharia e na Industria). 1980. 10p. (In Portuguese). (CONF-8012116—5). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703936.

From 4. Brazilian congress on materials science and engineering; Camboriu, Brazil (15 Dec 1980).

By means of electrical resistivity measurements the solution of He in the Nb-2,5% Zr alloys was studied with and without neutron irradiation. The resistivity increases with the He diffusion in the alloys during isothermal annealings. These isothermal annealings permit the determination of parameters like: relaxation time, diffusion coefficients activation energy and vacancies supersatura-

tion. A contribution to materials technology of power reactors, is done. (Author).

6161 **(INIS-BR—67) Microhardness measurement in AISI 321 stainless steel with niobium additions before and after fast neutron irradiation.** Galli, V.L.; Lucki, G. (Instituto de Energia Atomica, Sao Paulo (Brazil). Centro de Aplicacao de Radioisotopos e Radiacao na Engenharia e na Industria). 1980. 8p. (In Portuguese). (CONF-8012116—6). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703937.

From 4. Brazilian congress on materials science and engineering; Camboriu, Brazil (15 Dec 1980).

Data about influence of neutron irradiation on the microhardness of stainless steel of type AISI 321 with 0.05 and 0.1wt.% Nb additions are presented. The microhardness measurements were made in the range of 300 to 650°C, before and after fast neutron irradiation with fluences about 10^{17}n/cm². Our results indicate that radiation damage peaks occur around 480°C for the stainless steel of type AISI 321 without Nb addition, around 500°C for the composition with 0.05 wt.% Nb addition and around 570°C for the composition with 0.1 wt.% Nb addition. Microhardness data are in agreement with those obtained by means of electrical resistivity measurements, performed at the same conditions. (Author).

6162 **(INIS-BR—68) Effects of neutron irradiation in magnetic properties of metals and alloys.** Sciani, V.; Lucki, G. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1980. 10p. (In Portuguese). (CONF-8012116—7). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703938.

From 4. Brazilian congress on materials science and engineering; Camboriu, Brazil (15 Dec 1980).

The effects of neutron irradiation on the magnetic properties of metals and alloys, namely magnetic anisotropy, hysteresis loop, initial magnetic permeability, which are sensitives to structural changes, are studied. First a short review is made, followed by experimentals results and the plot of the vacancies supersaturation, which are obtained in the reactor of the Instituto de Pesquisas Energeticas e Nucleares. (Author).

6163 **(INIS-BR—69) Effects of pre-deformation in topological characterization of Inconel 600 submitted to isothermal treatments.** Mourao, D.R.; Silveira, T.L. da; Monteiro, E. (Pontifica Univ. Catolica do Rio de Janeiro (Brazil). Inst. Tecnologia). 1980. 10p. (In Portuguese). (CONF-8012116—8). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703939.

From 4. Brazilian congress on materials science and engineering; Camboriu, Brazil (15 Dec 1980).

INCONEL 600 samples were performed at thermal treatment between 550°C and 790°C during 3 hours after uniaxial tension testing. At each pair hardening-temperature were determined the microhardness and microstrostructure. With the objetive of to determine the influence of the hardening up to INCONEL's mechanical behavior, were plotted microhardness X temperature. (Author).

6164 **(INIS-BR—70) Mechanical and structural characteristics in high temperature of stainless steel welded joint.** Monteiro, S.N.; Carvalho Mota, A.F. de; Silveira, T.L. da. (Rio de Janeiro Univ. (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia). 1980. 11p. (In Portuguese). (CONF-8012116—9). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703940.

From 4. Brazilian congress on materials science and engineering; Camboriu, Brazil (15 Dec 1980).

The mechanical behavior at 600°C of weldments made of type 304 stainless as base metal and niobium containing type 347 stainless as weld metal has been investigated. This was done through tensile and creep tests. Heat treatments at 600°C and up to 6000 hours permited a simultaneous follow up of the mechanical and microstructural changes. It was observed that the exposure at 600°C under load contributes, from the begining, to the strengthening of the weld. This is due to the acceleration of the second phase precipitation hardening. (Author).

6165 **(INIS-BR—71) Inaccuracy of reference curves used in the structures design by creep rupture indices.** Couto, P.R.G.; Silveira, T.L. da; Monteiro, S.N. (Faculdade de Engenharia Souza Marques, Rio de Janeiro (Brazil)). 1980. 13p. (In Portuguese). (CONF-8012116—10). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83703941.

From 4. Brazilian congress on materials science and engineering; Camboriu, Brazil (15 Dec 1980).

The majority of Project Codes considers explicity rupture as one of the critereas for the extinction of the life of structures which operate at high temperatures. The modifications of the materials deformation and fracture mechanisms, are discussed. Their effects on the creep rupture indices used on projects are also considered in terms of parametric methods. (Author).

6166 **(INIS-BR—72) Metallographic studies of eutectics carbides in high niobium microalloyed steels.** Kestenbach, H.J.; Itmen, A.; Nishi, A.M.; Roca, I.B.; Valentin, C. (Sao Carlos Univ. (Brazil). Dept. de Engenharia de Materiais). 1980. 10p. (In Portuguese). (CONF-8012116—11). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703942.

From 4. Brazilian congress on materials science and engineering; Camboriu, Brazil (15 Dec 1980).

The quantity, distribution and effectiveness of eutectic carbides was studied in high niobium microalloyed steels. The particles showed extremely inhomogenuous distributions and seemed to be ineffective in promoting refinement of either an austenitic, ferritic or perlitic microstructure. There is a definite need for better quantitative data about the fraction of Nb 'lost' to eutectic particles in these steels. (Author).

6167 **(INIS-BR—73) Effects of austenitizing temperature in quenched niobium steels.** Mello, F.B.C. de; Assuncao, F.C.R. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Dept. de Ciencia dos Materiais e Metalurgia). 1980. 12p. (In Portuguese). (CONF-8012116—12). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703943.

From 4. Brazilian congress on materials science and engineering; Camboriu, Brazil (15 Dec 1980).

Three steel compositions with varying Nb content were austenitized at different temperatures and quenched in cold water. Metallographic examination and hardness measurements provided a basis for explaining the hardening mechanism and the role of Nb on the process. (Author).

6168 **(INIS-BR—74) Determination of densities from chemical composition and X-Ray diffraction.** Azevedo, A.L.T. de. (USIMINAS, Ipatinga (Brazil). Centro de Pesquisas). 1980. 10p. (In Portuguese). (CONF-8012116—13). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703944.

From 4. Brazilian congress on materials science and engineering; Camboriu, Brazil (15 Dec 1980).

X-ray diffraction method applied to retained austenite measurements gives volume per cent results, whereas the same kind of measurement made by Moessbauer Effect gives iron percentages. To compare both results one needs to convert the volume % to weight % or vice-versa. This necessitates, among other things, in determining the densities of the α and γ phases in the steel being studied. A method for calculating the densities, based on the application of the definition of density to just one unit cell, using X-ray diffraction and chemical results, are described. (Author).

6169 **(INIS-BR—75) Viabilization of a new aluminium grain refiner based on Zirconium halide salt.** Robert, M.H.; Cupini, N.L. (Universidade Estadual de Campinas (Brazil). Faculdade de Engenharia). 1980. 11p. (In Portuguese). (CONF-8012116—14). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703945.

From 4. Brazilian congress on materials science and engineering; Camboriu, Brazil (15 Dec 1980).

A new aluminium grain refiner based on Zirconium halide salt is proposed. Its efficiency, as grain refiner is analysed varying the salt amount, the inoculation temperature and holding time. The

grain size reduction shows to be dependent on the salt amount and independent on the inoculation temperature. The holding time effects is dependent on the innoculated salt amount. (Author).

6170 **(INIS-BR—76) Simultaneous effects of mechanical vibration and inoculation with niobium on the solidification structure of aluminium.** Mello, J.D.B. de; Arruda, A.C.F. de. (Universidade Federal de Uberlandia (Brazil). Centro de Ciencias Exatas). 1980. 9p. (In Portuguese). (CONF-8012116—15). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703946.

From 4. Brazilian congress on materials science and engineering; Camboriu, Brazil (15 Dec 1980).

This study concerns the effect of mechanical vibration applied simultaneously with inoculation (0,05% Nb) on the solidification structure of aluminium, with a view to refining the grain size. The results shows that the method used is an efficient way to control the final structure of the aluminium. The best results were found for low values of the frequencies of vibration and for the small amplitudes. (Author).

6171 **(INIS-mf—8292) Preparation of V_3Ge single crystals by zone melting and investigations of superconductive parameters before and after neutron irradiation.** Conrad, R. (Stuttgart Univ. (Germany, F.R.). Fakultaet 12 fuer Physik). 19 Dec 1980. 65p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84700518.

1. A reproducible method of growing V_3Ge single crystals by inductive zone melting and electron beam zone melting was developed. 2. During melting the alloy partners germanium evaporates overproportional. By controlled compensation of these wastes a nearly stoichiometric compound could be prepared. 3. The Ge content of single crystals varies very strongly over sample length however within homogeneity range of V_3Ge. Thus the superconductive properties within a crystal vary, too. 4. The maximal transition temperature of 6.2 K was found with V_3Ge single crystals at a Ge content of about 23 atomic percentage. The neutron irradiation of V_3Ge single crystals yielded: 1. The transition temperature of V_3Ge crystals decreases monotonously with increasing irradiation dose. 2. The critical current density and volume adhesion increase drastically after n-irradiation. 3. The maximal volume adhesion depends strongly on the sample quality. The higher the atomic defect density in a sample before neutron irradiation the higher the maximal adhesion after irradiation. 4. The experiments show that the V_3Ge single crystals have an inhomogeneous radiation induced disorder.

6172 (INIS-mf—8672, pp 41) **Investigations on powder metallurgical CuSn-Nb_3Sn fibre compound superconductors.** Eibler, R.; Hilscher, G.; Kirchmayr, H.; Wiesinger, G. (Technische Univ., Vienna (Austria). Inst. fuer Experimentalphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6173 (INIS-mf—8672, pp 41) **Investigation of hydrogen absorption in Zr(Fesub(1-x)Mnsub(x))$_2$.** Hilscher, G.; Kirchmayr, H.; Stampfl, H.; Wiesinger, G. (Technische Univ., Vienna (Austria). Inst. fuer Experimentalphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6174 (INIS-mf—8672, pp 44) **Band magnetism in cubic Laves phases.** Mohn, P.; Schwarz, K. (Technische Univ., Vienna (Austria). Inst. fuer Technische Elektrochemie). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6175 (INIS-mf—8672, pp 49) **Magnetic anisotropy of rare earth permanent magnets.** Groessinger, R.; Obitsch, P.; Kirchmayr, H. (Technische Univ., Vienna (Austria). Inst. fuer Experimentalphysik); Velicescu, M. (UGIMAG RECOMA AG, Lupfig (Switzerland)). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6176 (INIS-mf—8672, pp 52) **Discontinous yield in Cu-Be_2.** Zuercher, R.; Groeger, V.; Stangler, F. (Vienna Univ. (Austria). Inst. fuer Festkoerperphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6177 (INIS-mf—8672, pp 52) **Influence of metastable phases on Vickers microhardness and resistance at different age hardenings of Cu-Be_2.** Sachslehner, F.; Groeger, V.; Stangler, F. (Vienna Univ. (Austria). Inst. fuer Festkoerperphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6178 (INIS-mf—8672, pp 17) **Semi-magnetic semiconductors.** Bauer, G. (Montanistische Hochschule, Leoben (Austria). Inst. fuer Physik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6179 (INIS-SU—196, pp 46-48) **Radiation spectra and degree approximation for intersurface potential.** Gendenshtejn, L.Eh.; Pegushin, E.V. 1982. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8105209—No.1(19)).

From All-union seminar electromagnetic interactions of hadrons in the resonance energy range; Khar'kov, Ukrainian SSR (26 May 1981).

A type of interplanar potential parametrization (fractional parametrization) which simplifies calculations of radiation spectra of channeling particles in dipole approximation is suggested. In this case a possibility of increasing the intensity and degree of positron radiation monochromatism during channeling in monocrystals is considered when the beam is directed at a certain angle to crystallographical planes. An essential increase of intensity is shown on the example of diamond and tungsten.

6180 **(PNL-SA—11488) Corrosion behavior of Ni^+-ion irradiated NiTi alloys.** Wang, R.; Brimhall, J.L. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1983. Contract AC06-76RL01830. 14p. (CONF-831174—38). NTIS, PC A02/MF A01. Order Number DE84003891.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

Corrosion behavior of Ni^+-irradiated NiTi alloys was studied in chloride solutions, together with unirradiated NiTi material with different surface conditions. Ion irradiation with either 2.5 or 5 MeV Ni^+ ions transformed the NiTi surface into an amorphous layer up to 1.5 micrometers thick. Studies of corrosion potential vs time and polarization behavior indicated a small enhancement of the passivation for the Ni^+-irradiated NiTi over the unirradiated NiTi. The unirradiated NiTi with a mechanically polished, course surface was susceptible to pitting and crevice corrosion attack in 1 N HCl solution. The homogeneous amorphous structure in the irradiated alloy retarded this type of localized corrosion.

6181 **(RHO-WM-SR—83-1-3Q-P) Long-term high-level defense waste technology progress report, April-June 1983.** (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Aug 1983. Contract AC06-77RL01030. 20p. NTIS, PC A02/MF A01. Order Number DE84004564.

This report summarizes the work accomplished on the Long-Term High-Level Defense Waste (HL) end function during the third quarter of fiscal year 1983. Rockwell is providing technical guidance for waste tank and cesium capsule corrosion tests being performed at Battelle Pacific Northwest Laboratory (PNL) and pass-through funded concrete grout alpha radiolysis studies and support of the Transportable Grout Facility (TGF) Demonstration Project by Oak Ridge National Laboratory (ORNL). The residual liquid solidification of in-tank wastes studies and the alternative waste fixation assessment studies were terminated at the end of the second quarter, and the emphasis was redirected to the TGF project. A support task also being funded at Rockwell under this program is to provide liaison to PNL and ORNL on waste immobilization studies in support of the TGF. The waste tank and cesium capsule corrosion testing efforts at PNL have focused on data collection and evaluation. Time dependence of the corrosion rates appears to be following the rate-reduction-with-time expectation. Dilute waste tank solutions show higher corrosion rates than more concentrated solutions. All work is on schedule, and no problems are foreseen in completing the tests. The lead site funded Waste Management Development Support Building (Project B-409) was completed. 6 tables.

6182 **(SAND—83-1423C) Friction and wear reduction of 440C stainless steel by ion implantation.** Pope, L.E.; Yost, F.G.; Follstaedt, D.M.; Picraux, S.T.; Knapp, J.A. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 8p. (CONF-831174—30). NTIS, PC A02/MF A01. Order Number DE84003255.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

Portions are illegible in microfiche products.

Friction and wear tests on ion-implanted 440C stainless steel discs have been extended to high Hertzian stresses (≦ 3150 MPa). Implantation of 2 x 10^{15} Ti/mm^2 (180 to 90 keV) and 2 x 10^{15} C/mm^2 (30 keV) into 440C reduces friction (~ 40%) and wear (> 80%) for Hertzian stresses as large as 2900 MPa, stresses which significantly exceed the yield strength of 440C (~ 1840 MPa). Implantation of 4 x 10^{15} N/mm^2 (50 keV) into 440C reduces friction slightly (~ 25%) for Hertzian stresses < 1840 MPa but provides little or no reduction in wear. The amount of Ti remaining in the wear tracks correlates with the reductions in friction and wear. The implantation of Ti and C produces an amorphous surface layer which is believed to reduce friction and wear, whereas N implantation is expected to produce hard nitride particles which probably do not modify the hardness of 440C (KHN = 789) significantly.

6183 **(Y—2286) Effect of small additions of silicon, iron, and aluminum on the room-temperature tensile properties of high-purity uranium.** Ludwig, R.L. (Oak Ridge Y-12 Plant, TN (USA)). 14 Nov 1983. Contract W-7405-ENG-26. 42p. NTIS, PC A03/MF A01. Order Number DE84004979.

Eleven binary and ternary alloys of uranium and very low concentrations of iron, silicon, and aluminum were prepared and tested for room-temperature tensile properties after various heat treatments. A yield strength approximately double that of high-purity derby uranium was obtained from a U-400 ppM Si-200 ppM Fe alloy after beta solution treatment and alpha aging. Higher silicon plus iron alloy contents resulted in increased yield strength, but showed an unacceptable loss of ductility.

6184 **Low temperature laser quenching studies of superconducting Mo—N and Mo—C alloys.** Sekula, S.T.; Thompson, J.R.; Beardsley, G.M.; Lowndes, D.H. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Journal of Applied Physics;* **54**: No. 11, 6517-6521(Nov 1983). Contract W-7405-ENG-26.

Concentrated alloys of Mo/sub 1-x/ N/sub x/ and Mo/sub 1-x/ C/sub x/ were produced in near-surface layers by implantation of the respective ionic species into Mo foils or films at elevated temperatures. Subsequently the materials were rapidly heated and "laser quenched" while affixed to a substrate at 5 K. In situ measurements of the superconductive transition temperature after laser irradiation showed increases in T/sub c/ to ~6.5 K for a range of compositions x>30 at. % for both N and C implanted foils. For x<30 at. % little change was observed. Finally, the T/sub c/ of a Mo—C film with x = 43 at. % rose to 12.0 K following 0.5 J/cm^2 of incident energy from the Q-switched ruby laser.

6185 **Observation of thermoelectrically induced charge imbalance in superconducting aluminum.** Mamin, H.J.; Clarke, J.; Van Harlingen, D.J. (Department of Physics, University of California, Berkeley, California 94720 and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review Letters;* **51**: No. 16, 1480-1483(17 Oct 1983). Contract AC03-76SF00098.

The quasiparticle transport current induced in a superconducting aluminum film by a temperature gradient has been detected by measurements of the spatially decaying charge imbalance generated near the end of the sample where the current is divergent. The results are in good agreement with theory when the nonuniformity of the temperature gradient is taken into account. In particular, the inferred value of the thermopower agrees well with the value obtained when the aluminum is in the normal state.

6186 **Observation of a first-order structural phase transition in a monolayer of Pd on Nb(110) and its relationship to electronic structure.** Sagurton, M.; Strongin, M.; Jona, F.; Colbert, J. (Department of Materials Science and Engineering, State University of New York at Stony Brook, Stony Brook, New York 11794). *Physical Review* [*Section*] *B: Condensed Matter;* **28**: No. 8, 4075-4079(15 Oct 1983).

It is shown that a commensurate 1 x 1 monolayer of Pd on a Nb(110) surface undergoes a first-order structural phase transition to an incommensurate monolayer Pd(111) structure when roughly-equal18% more Pd atoms are added to the surface. We find, however, that this phase transition has no substantial effect on the surface electronic structure. A steady shift toward the Fermi level of the local density of states at the surface is found as the Pd coverage is increased beyond about one monolayer. This shift correlates quite well with a previously observed increase in the hydrogen uptake rate.

6187 **Ab initio study of structural and electronic properties of beryllium.** Chou, M.Y.; Lam, P.K.; Cohen, M.L. (Department of Physics, University of California, Berkeley, California 94720 and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review* [*Section*] *B: Condensed Matter;* **28**: No. 8, 4179-4185(15 Oct 1983).

An ab initio calculation of the structural and electronic properties of beryllium is presented. The calculational method used is the self-consistent pseudopotential approach within the local-density-functional scheme. The calculated lattice constants, cohesive energy, bulk modulus, Poisson's ratio, electronic band structure, density of states, and charge density are all in good agreement with the experimental measurements.

6188 **Effects of d-f correlation on the mixed-valent properties of Ce systems.** Liu, S.H.; Ho, K. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Physical Review* [*Section*] *B: Condensed Matter;* **28**: No. 8, 4220-4226(15 Oct 1983). Contract W-7405-ENG-26;W-7405-ENG-82.

In a recent paper it was suggested that the double-peak 4f photoemission spectra of Ce and Ce /sub 0.9/Th/sub 0.1/ indicate strong d-f correlation. This paper discusses the effects of this correlation on the mixed-valent properties of Ce systems. In the impurity-lattice approximation, which is valid at high temperatures, the f-electron spectrum has the well-known x-ray-edge singularity at the Fermi level. The inclusion of d-f hybridization adds fine structures to the spectrum near the Fermi level. Fur- p thermore, the singularity can account for the Kondo-type resistivity and specific-heat anomalies without the need to invoke spin-flip scattering.

6189 **Effect of Langreth-Mehl gradient correction on transition-metal band structures: Copper and vanadium.** Norman, M.; Koelling, D.D. (Department of Physics and Quantum Theory Group, Tulane University, New Orleans, Louisiana 70118). *Physical Review [Section] B: Condensed Matter;* **28**: No. 8, 4357-4362(15 Oct 1983). Contract W-31-109-ENG-38.

The Langreth-Mehl gradient correction to the local-density approximation (LDA) for the exchange-correlation functional is tested with the use of band-structure calculations for two representative transition metals: Cu and V. Compared to the LDA results, it is found that the major effect is a relative s-d shift of 9 mRy. This upward shift of the d bands is beneficial in the case of vanadium, but not in the case of copper. We discuss the significance of these observations in light of the systematics of the transition series.

6190 **First principles phonon spectra in Ca and Sr.** Moriarty, J.A. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Physical Review [Section] B: Condensed Matter;* **28**: No. 8, 4818-4821(15 Oct 1983).

Experimental phonon spectra for the fcc alkaline-earth metals Ca and Sr have only recently been obtained. First-principles, generalized-pseudopotential-theory predictions of these spectra, including the full effects of d-state hybridization, are reported and compared with these results. The overall agreement between theory and experiment is found to be quite good (within about 10%). In addition, anomalous behavior observed in the $T_1[110]$ branch for single-crystal Ca is also found theoretically.

6191 **Inelastic—neutron-scattering study of (111) LA phonons in Nb_3Sn.** Axe, J.D.; Shirane, G. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] B: Condensed Matter;* **28**: No. 8, 4829-4830(15 Oct 1983). Contract AC02-76CH00016.

The phonon dispersion of (zeta,zeta,zeta) LA phonons is determined for zeta< or =0.24. The pronounced anomaly predicted by a recent first-principles treatment of electron-phonon interactions is not observed.

6192 **Investigations into the detection of corrosion damage of austenitic components using pulsed eddy current testing.** Wittig, G.; Thomas, H.M.; Wenke, H. pp vp of Jubilee meeting: 50 years of DGZfP. Non-destructive testing: Past, present, future. Abstracts. Berlin, Germany, F.R.; Deutsche Gesellschaft fuer Zerstoerungsfreie Pruefung e.V. (1983). (In German)(CONF-8305144—Absts.).

From Jubilee meeting: 50 years of DGZfP meeting on non-destructive testing: past, present, future; Berlin, F.R. Germany (8 May 1983).

6193 **Jubilaeumstagung: 50 Jahre DGZfP. ZfP in Vergangenheit, Gegenwart, Zukunft. (Jubilee meeting: 50 years of DGZfP. Non-destructive testing: past, present, future. Abstracts).** Berlin, Germany, F.R.; Deutsche Gesellschaft fuer Zerstoerungsfreie Pruefung e.V. (1983). vp. (In German). (CONF-8305144—Absts.). Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe, Germany, F.R.

From Jubilee meeting: 50 years of DGZfP meeting on non-destructive testing: past, present, future; Berlin, F.R. Germany (8 May 1983).

Separate indexing was prepared for items within the scope of the Energy Data Base.

6194 **Coordination cluster theory: description of the activity coefficients of dilute solutions of oxygen and sulfur in binary alloys.** Saboungi, M.L.; Cerisier, P.; Blander, M. (Argonne National Lab., IL). *Metallurgical Transactions, [Section] B: Process Metallurgy;* **13B**: 429-437(Sep 1982).

The activity coefficients of dilute solutions of oxygen and sulfur in some binary alloy (Cu-Ni, Ag-Sn, Ag-Cu, Pb-Sn, or Ag-Pb) are analyzed in terms of three models - the quasi-chemical theory, the ideal solvent model, and the coordination cluster theory. The first theory does not give a satisfactory representation of a large fraction of the data. The ideal solvent model provides a good representation of a majority of the systems. However, the coordination cluster theory provides a consistently good description of the data. Only one unknown parameter is present in the analytical expressions of the activity coefficients of the solute in the latter two theories. This parameter is related to physical quantities and, in principle, can be independently determined experimentally or theoretically.

6195 **Corrosion of heat exchanger materials in simulated fluidized bed combustion environments.** Natesan, K. (Argonne National Lab., IL). *Corrosion (Houston);* **38**: No. 7, 361-373(Jul 1982).

Metallic materials selected for the construction of in-bed heat exchangers in fluidized bed combustion (FBC) systems must withstand the corrosive conditions prevalent in these systems. The corrosion behavior of carbon steel, chromium-molybdenum ferritic steels, Type 310 stainless steel, and Incoloy 800 has been evaluated after exposure to complex gas mixtures that simulate conditions anticipated in FBC systems. Experiments have been conducted on internally cooled tube specimens with metal temperatures of 977 and 866°K and gas temperatures in the range 999 to 1123°K. Results are presented on the gas-metal interactions and the scale morphologies as a function of gas chemistry, alloy type, and system temperature. Experimental results are also presented on the corrosion behavior of candidate materials coated with deposits such as $CaSO_4$, CaO, and $CaO/CaSO_4$ mixtures. The information has been used to examine the effects of the type of deposit and deposit sequence on the scale development and grain boundary penetration of oxygen or sulfur in the substrate material.

6196 **Absorption of cesium by stainless steel from liquid sodium-caesium solutions.** Macefield, P.J. Nottingham, England; Nottingham University (1982). 240p. British Library, Boston Spa, Wetherby, West Yorks. No. D44777/83.

Thesis.

Stainless steel (types AISI 321) has been shown to be inert towards sodium containing 3 wppm caesium and less than 20 wppm oxygen over 635 d at 673 K. Stainless steel (type AISI 316) has been shown to be inert towards both pure caesium and sodium-caesium solutions (up to 50 wppm caesium) containing less than 20 wppm oxygen over 115 d at 873 K. Penetration and corrosion by the liquid metals was negligible. The addition of ca. 2 mol.% oxygen to the pure caesium caused minor grain-boundary corrosion of the steel, revealed after chemical etching to be ca. 10 μm in depth after 25 d at 873 K. The only corrosion product detected was chromium. By diluting the caesium with sodium and then adding 0.35 mol.% oxygen to the sodium-caesium system produced a more corrosive liquid which caused more severe grain-boundary degradation of the steel surface. The corrosion mechanism in each case is thought to begin with the formation of Cr_2O_3 on the steel surface which then undergoes further reaction with the alkali metal. Grinding the flat steel surface against an abrasive paper allowed the removal of thin sections and by this with a γ-tracer technique, depth profiles were determined for the caesium penetration from sodium-caesium solutions. The results are reported, analysed and discussed.

6197 **Irradiation effects in degassed and oxygen-doped niobium.** Meekison, C.D. Brighton, England; Sussex University (1982). 327p. British Library, Boston Spa, Wetherby, West Yorks. No. D44953/83.

Thesis.

Ion and electron radiation damage in degassed and oxygen-doped niobium was investigated by means of ion channelling and transmission electron microscopy. Channelling was also used to study the effect of the irradiations on the oxygen lattice site, using the nuclear reaction ^{18}O (p,α) ^{15}N. Electron microscopy after irradiation with 2.0 MeV $^4He^+$ ions at 293 K and 86 K showed small dislocation loops. These were smaller and more numerous for the lower-temperature irradiation and the oxygen-doped samples. The effective interstitial migration energy was found to be about 0.03 eV. Irradiation of oxygen-doped niobium near 330 K with 2.0 MeV electrons created loops. The measured energy dependence of the dechannelling of $^4He^+$ ions in degassed niobium irradiated with 2.0 MeV $^4He^+$ ions at 293 K indicated dislocations, identified with the loops above, and defects causing single scattering. Channelling measurements of damage by protons, helium, and nitrogen ions in-

dicated effects of the cascade energy. Channelling measurements at 10 K as a function of helium-ion irradiation dose showed increases of both the dechannelling and the surface minimum yield, oxygen in the niobium having no significant effect. The lattice location of oxygen was found to be changed by ion irradiation at both 293 K and 10 K, except for proton damage at 10 K.

6198 **Activity of hydrogen in metal-hydrogen systems: strontium, thorium-nitrogen and vanadium alloys.** Nelson, S.O. Ames, IA; Iowa State Univ. (1982). 78p. University Microfilms Order No. 8221212.

Thesis (Ph.D.).

The dissolution of hydrogen gas has been studied by means of hydrogen pressure-composition isotherms in strontium, thorium-nitrogen and vanadium alloys containing either niobium, chromium or titanium. Direct hydrogen equilibrium vapor pressure measurements were performed in the strontium-hydrogen and thorium-nitrogen-hydrogen systems in the ranges 973 to 1173 K and 623 to 1123 K, respectively. An indirect method, an isopiestic solubility technique, was employed to measure the hydrogen equilibrium pressures for the vanadium alloys in the range 223 to 473 K. In all the alloys studied, the reaction of hydrogen with the metal phase was exothermic and hydrogen followed Sieverts' law over a considerable range of hydrogen concentration. The enthalpy of solution of hydrogen in the strontium metal and the enthalpy of formation of ThNH/sub x/ were determined to have the values of -14.3 +/- 1.2 kcal/mol H and -16.3 +/- 1.5 kcal/mol H_2, respectively. The values of the enthalpies of solution of hydrogen for the vanadium alloys ranged from -8.0 to -10.5 +/- 0.3 kcal/mol H. Additions of titanium to vanadium dramatically enhanced the isopiestic solubility of hydrogen, chromium significantly reduced the solubility and niobium moderately increased the solubility. Sieverts' law behavior for hydrogen in the vanadium alloys showed that substitutional atoms did not act as deep traps for hydrogen.

6199 **Thermodynamics of the incongruently subliming niobium-tin system.** Schiffman, R.A.; Bailey, D.M. (Ames Lab., IA). *High Temperature Science;* **15**: No. 2/3, 165-177(1982). Contract W-7405-ENG-82.

The niobium-tin system was investigated in the temperature range 1261-2076 K by measurement of tin vapor pressures with a simultaneous weight loss-mass-spectrometric technique. For the reaction Nb + 1/3Sn → $NbSn_{1/3}$, $\Delta H/sub\ f/^{298}$ was found to be -21.59 kJ/mol. The heat of solution of tin in niobium was determined as a function of composition. The temperature-composition diagram for the niobium-tin system above 1200°C was constructed. The Nb_3Sn phase has a narrow homogeneity range from 25 to 28 at% tin below 1600 K that broadens to include 18 at% tin at 2076 K.

6200 **Thermodynamics of congruently subliming cerium-antimony.** Schiffman, R.A.; Franzen, H.F. (Ames Lab., IA). *High Temperature Science;* **15**: No. 2/3, 179-185(1982). Contract W-7405-ENG-82.

Congruently vaporizing cerium-antimony has been investigated by vapor pressure measurementa using a simultaneous weight-loss mass-spectrometric Knudsen effusion technique. The melting point of the 1:1 stoichiometry was determined to be 2179 +/- 10 K. The heat of formation at 298 K of CeSb was found to be -128.9 kJ/g-at from thermodynamic measurements in the temperature range 1985-2172 K.

6201 **Photoemission from condensed layers of H_2 on Cu and Au.** Eberhardt, W. (Brookhaven National Lab., Upton, NY); Cantor, R.; Greuter, F.; Plummer, E.W. *Solid State Communications;* **42**: No. 11, 799-802(1982). Contract AC02-76CH00016.

We have measured the photoemission of monolayers as well as thick films of H_2 molecules condensed onto Cu and Au. The adsorbed monolayer exhibits a relaxation energy of 1.75 eV whereas we see a bandlike ls state for thick layers having a bandwidth of 1.2 eV. We also observe energy loss features which are in agreement with previous electron energy loss and optical absorption studies.

6202 **Computer simulation of tracer diffusion in a concentrated alloy with short-range order.** Murch, G.E. (Argonne National Lab., IL). *Philosophical Magazine,* [*Part*] *A: Defects and Mechanical Properties;* **45**: No. 6, 941-956(1982). Contract W-31-109-ENG-38.

Tracer diffusion via vacancies in a simple-cubic binary alloy with short-range order has been simulated using a Monte Carlo method. Extensive results for the jump frequencies and tracer correlation factor were collected for both components over the entire composition range. It was found that Arrhenius plots of the tracer diffusion coefficient have extended linear regions. Where there is an order/disorder boundary at lower temperatures the plots curve downwards. This behavior has also been found in the stoichiometric b.c.c. alloy by Bakker, Stolwijk, Van der Meij and Zuurendonk (1976).

6203 **Large strain multidirectional deformation of 1100 aluminum at 300°K.** Armstrong, P.E. (Los Alamos National Lab., NM); Hockett, J.E.; Sherby, O.D. *Journal of the Mechanics and Physics of Solids;* **30**: No. 1/2, 37-58(1982). Contract W-7405-ENG-36.

Multidirectional compression testing of 1100 aluminum cubes at room temperature in three orthogonal directions developed saturation flow stresses at very large accumulated strains. The saturation stress was found to be a function of the strain increment used, and followed a power-law relationship. The results correlated well with fatigue tests of aluminum and alpha iron. Copper data showed a similar but more pronounced behavior. The presence of dislocation cells, subgrains and dislocation tangles dominated the microstructure as observed by transmission electron microscopy. The microstructure changed in a systematic manner with accumulated straining. Significant differences in sizes and concentrations of cells and subgrains were found for unidirectional compared with multidirectional straining. These features were correlated using generally accepted relationships between individual substructural configurations and flow stress.

6204 **Auger line shape analyses for epitaxial growth in the Cu/Cu, Ag/Ag and Ag/Cu systems.** Vook, R.W.; Namba, Y. (Syracuse Univ., New York). *Applications of Surface Science;* No. 11/12, 400-407(1982). Contract AC02-77ER04496.

A new measure of the MVV doublet Auger line shape called the R-factor has been applied to homoepitaxial layer growth on (111) Cu and on (111) Ag as well as to the heteroepitaxial growth of (111) Ag on (111) Cu. AES and TEM show that as thick (~ 1500A) monocrystalline Cu and Ag films grow thicker, R oscillates with a period equal to one atomic layer. Polycrystalline films do not show such a periodicity. The changes in doublet line shape are interpreted as arising from the superposition of two sets of doublets slightly displaced in energy. One set is presumed to come from the flat areas of the film and the other from the edge areas of incomplete layers. The origin of the periodicity in R arises then from the atomic relaxations that can be expected at the edges of surface steps, whose density varies periodically during growth. For the initial stages of (111) Ag growth on (111) Cu, an initially high R/sub Ag/ decreased to bulk values as the Ag thickened beyond one or two monolayers for both polycrystalline and monocrystalline films; but the periodicity in R/sub Ag/ was detected only for monocrystalline growth. The high initial values of R/sub Ag/ are interpreted as arising from changes in the energy levels of the corresponding Auger transitions with changing interatomic spacing. Since the Ag overgrowth is compressed towards the smaller lattice parameter of the Cu substrate, energy levels in the valence band of Ag might be expected to become more widely separated. Consequently a more highly resolved MVV doublet for Ag would occur, resulting in a larger R/sub Ag/.

6205 **Direct calculation of experimentally measurable chemisorptive parameters from theoretical quantum chemical cluster models.** Schwartz, M.E. (National Univ. of Ireland, Maynooth). *Applications of Surface Science;* **11/12**: 157-163(1982).

OAl_3, OAl_4, and two different OAl_6 clusters are used to model O chemisorption in the threefold sites of the (111) face of Al metal. A gaussian-based model potential theory for valence elec-

trons only allows the ready calculation of the equilibrium O position and vibrational frequency, and of the electron distribution. These studies show that the O atom has nearly constant character in all clusters/states studied, with edge effects of little importance. Calculated AlO bond lengths are accurate when compared to critically discussed experimental results deduced from EXAFS measurements. Use of a real all-electron O atom gives accurate calculated O ls binding energies when compared to ESCA measurements and other calculations. O-surface vibrational frequencies are predicted to be around 400 cm^{-1}, clearly different from predicted values around 525 cm^{-1} for a bridge site and 625 cm^{-1} for an overhead site; these can be subject to EELS experimental study. The theory thus seems able to predict and interpret experimental quantities, and a few related theoretical results for NO on Al and O on Zn are given as examples of the further utility of the theoretical models and techniques.

6206 **Anodic oxidation of ion implanted aluminium.** Buonaquisti, A.D. Lancaster, England; Lancaster University (1981). 324p. British Library, Boston Spa, Wetherby, West Yorks. No. D37542/81.

Thesis.

The effect of ion bombardment on aluminium was studied in detail and the results indicated that this phenomenon could influence the corrosive process as described by oxide ratio values. The annealing conditions suitable for the repair of this 'radiation damage' were determined. With chemically active implants two types of behaviour were noted, these being associated with the different doses of implant. Above $1x10^{16}$ ions cm^{-2} spontaneous corrosion was observed when the specimens were exposed to the atmosphere. Below this threshold dosage anodic growth was effected by the implant.

6207 **Grain boundary deformation: the role of grain boundaries in yielding of polycrystalline metals and alloys.** Murr, L.E. (New Mexico Inst. of Mining and Tech., Socorro); Wang, S.H. *Res Mechanica Letters;* 85-90(1981).

The results of this study show the following sequence of events in terms of microstructural changes in response to an applied strain. At low strains grain boundary dislocation motion occurs and grain boundary dislocations can interact to form ledges in the interface. Ledges existing in the interface or formed by grain boundary dislocation interactions are activated to emit arrays of dislocations (in emission profiles which, as a result of resolved stresses, appear identical to dislocation pile-ups). The frequency of sources increases with applied strain and at the engineering yield point all grains contain at least one such emission profile. With increasing strain, the number of such profiles increases while the profiles remain about the same length. At 2% strain, dislocations begin to pile up at opposite boundaries and the piled-up dislocations can interact with grain boundary dislocations. Additional ledge sources can be created, and dislocations on conjugate slip systems emitted from around the circumference of individual grain interfaces begin to interact, forming additional dislocations. As the strain increases beyond about 6%, the volume fraction of martensite roughly matches the strain level (in volume per cent). Over a wide range of low strains (0.05-2% strain), the grain boundary structure is changing very measurably. The fact that the grain boundary region has a finite width and that dislocations are mobile in the boundary phase can also explain the so-called spreading of extrinsic grain boundary dislocations at elevated temperature by the dissociated glide of grain boundary dislocations and their annihilation.

6208 **The effect of vanadium and vanadium plus titanium on the magnetic and mechanical properties of Fe-Cr-Co hard magnets.** Belli, Y. (Lawrence Berkeley Lab., CA); Mishra, R.K., Kubarych, K.; Okada, M. *Materials Science and Engineering;* 47: 69-75(1981). Contract W-7405-ENG-48.

The microstructure and magnetic properties of the Fe-Cr-Co hard permanent magnetic alloys with and without vanadium or vanadium plus titanium were studied using transmission electron microscopy and transmission Lorentz microscopy. Mechanical and magnetic properties were studied in parallel at different stages of the production. The three alloys 57Fe-15Co-28(Cr, V, Ti) (all compositions are in weight per cent) used for the present investigation had 28Cr, 23Cr-5V and 23Cr-3V-2Ti respectively. It is known that the magnetic properties of these alloys are improved by a heat treatment in a magnetic field. Improvement in the magnetic remanence B/sub r/ is due to elongation of the Fe-Co (α_1) phase parallel to the magnetic field direction. Subsequent step-aging or continuous-cooling treatments cause further phase separation with increased compositional differences between the phases without any microstructural changes and thus increase the coercive field H/sub c/. Lorentz microscopy shows that the matrix is weakly magnetic and that the magnetic hardening is due to domain wall pinning. Mechanical testing and fracture analysis show that the alloys are very ductile in the as-quenched state but become very brittle after the aging treatments. The embrittlement is severe for the ternary alloys and is most effectively retarded by the addition of vanadium or vanadium plus titanium. It is attributed to the high chromium content of the chromium-rich (α_2) phase and to the large grain size (a result of high homogenization temperature) of the ternary alloys. Since the addition of vanadium or vanadium plus titanium does not change the magnetic properties but improves the mechanical properties and makes the processing more convenient, the alloys with vanadium or vanadium plus titanium seem to be of commercial interest.

6209 **Deformation substructure in cemented WC-Co materials.** Kenik, E.A. (Oak Ridge National Lab., TN); Krawitz, A.D.; Drake, E.F. pp 56-57 of 39th annual proceedings of the Electron Microscopy Society of America. Bailey, G.W. (ed.). Atlanta, GA; Electron Microscopy Society of America (1981). Contract AC05-76OR00033;W-7405-ENG-26.

The cemented refractory carbides represent one of the basic classes of materials used in machine cutting and rock drilling tools. These multiphase materials (a refractory carbide compact with a metallic binder phase) provide a good combination of hardness, toughness, and abrasion resistance which leads to long tool life. The present study investigates the microstructure of several cobalt-based cemented WC materials in response to different types of mechanical loading.

6210 **Energy resolved phonon scattering in thin film amorphous solids.** Cattell, A.F. Glasgow, Scotland; Glasgow University (1980). 220p. British Library, Boston Spa, Wetherby, West Yorks. No. D43206/82.

Thesis.

Energy resolved phonon scattering measurements were performed using a novel heat pulse technique. Two thin film phonon generators were deposited on one face of a sapphire crystal substrate and two phonon detectors were deposited on the opposite face, under one of which a thin film amorphous material was deposited. The phonon detectors were superconducting tunnel heterojunctions. A comparison of the number of phonons detected at each junction gave information on the fraction of phonons transmitted through the amorphous film as a function of energy from which the phonon mean free path as a function of energy could be deduced. Materials investigated were silicon monoxide and germanium.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 5773, 5774, 5775, 5776, 5796, 5921, 5939, 6047, 6124, 6125, 6198

6211 **(CONF-831174—36) Ion beam modification of ceramics.** McHargue, C.J.; White, C.W.; Appleton, B.R.; Farlow, G.C.; Williams, J.M. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 9p. NTIS, PC A02/MF A01. Order Number DE84003302.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

Alterations to the structure and properties of ceramics are complex due to the range of bonding types encountered and the necessity for maintaining local charge balance. Ion damage can occur as a result of ionizing effects as well as displacement collisions. Ion species, implantation temperature, implantation energy, and the specific bonding characteristics of the host are important parameters in determining the structure and properties of implanted ceramics.

Some of these effects are illustrated for Al_2O_3 implanted with chromium or zirconium and silicon carbide implanted with chromium.

6212 **(CONF-831174—39) Diffusion mechanisms in transition-metal oxides.** Peterson, N.L. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 12p. NTIS, PC A02/MF A01. Order Number DE84003460.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

Results are presented for cation self-diffusion in Cu_2O and Cr_2O_3 as a function of temperature and deviation from stoichiometry. A defect model for Cu_2O involving neutral and singly charged copper vacancies, electron holes, and singly charged oxygen-interstitial ions is developed and fit to the tracer-diffusion data, the electrical-conductivity data, and the stoichiometry data, yielding concentrations and mobilities of these defects. The diffusion results for Cr_2O_3 single crystals indicate that cation self-diffusion takes place by triply charged vacancies and that previous diffusion results for polycrystalline Cr_2O_3 are dominated by grain-boundary diffusion.

6213 **(CONF-831174—47) Fast diffusion of iron in single crystal rutile and iron doped rutile.** Sasaki, J.; Peterson, N.L.; DeJonghe, L.C. (Lawrence Berkeley Lab., CA (USA); Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01. Order Number DE84004021.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

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Tracer diffusion coeffficients of Fe, D/sub Fe/, in single crystal of rutile and of 0 to 2.0% Fe doped rutile were measured. The oxygen pressure dependence of D/sub Fe/ in pure rutile showed complicated behavior. The values of D/sub Fe/ may consist of contributions from Fe^{2+} ions diffusing by an interstitial mechanism and from Fe^{3+} ions diffusing by an interstitialcy mechanism in cooperation with tetravelent titanium interstitial ions, Ti/sub i/. The value of D/sub Fe/ in Fe doped rutile attains a saturation value when the Fe content reaches about 0.1%. D/sub Fe/ decreases drastically when the Fe content exceeds about 0.35%. Complex impedance measurements of electrical conductivity indicate the existence of ionic conduction for Fe doped rutile containing less than 0.35% of Fe. The small ionic conductivity relation to the values of D/sub Fe/ suggests that only a small fraction of the iron ions are highly mobile. Above 0.35% Fe, the observed drastic decrease in D/sub Fe/ may result from the formation of a shear structure in highly doped rutile.

6214 **(DOE/SF/00098—T2) Protective coatings for combustion environments. Report for the period October 1981-December 1982.** Boone, D.H. (Lawrence Berkeley Lab., CA (USA)). 1982. Contract AC03-76SF00098. 48p. NTIS, PC A03/MF A01. Order Number DE84002187.

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Objective is to analyze the performance of coating systems designed to provide thermal barrier, high-temperature corrosion and wear protection to components of turbine and diesel engines. The erosion of partially stabilized zirconia ceramic thermal barrier coatings and of controlled-nucleation thermochemically deposited CVD SiC coatings was investigated. (DLC)

6215 **(Juel—1834) Investigation of inhomogeneity in ceramic reactor materials using laser-localized emission spectroscopy.** Siechau, R.; Mazurkiewicz, M.; Nickel, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). Mar 1983. 148p. (In German). Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe (Germany, F.R.).

Using Laser-localized emission spectroscopy, a method has been developed for the determination of elemental inhomogeneity within the grains of three coarse-grained ceramic materials - the mullite-based Durítals M70 and E90 and the silica-based Masrock -. The method had to be optimized to allow an acceptable detection of the elements to be analyzed in spite of the small quantities of evaporated material. A Laser-produced crater of 100 μm diameter and depth was found to be necessary to produce the required amount of evaporated material, 0,5 to 0,7 μg depending on the material composition. The results for Durital E90 showed that the large grains consisted of very pure mullite (2 $Al_2O_3xSiO_2$) and the fine grained regions contained small particles of mullite, corundum and binder, the impurities in the binder being concentrated at the grain boundaries. In Durital M70, the coarse and fine grained regions consisted principally of mullite, the impurities introduced during manufacture being evenly distributed in both regions. Analyses of the Masrock material showed a concentration of impurities in the fine grained regions with a very inhomogeneous distribution. The large grains consisted of nearly pure SiO_2. The distribution of impurity elements on the fracture surfaces of ceramics tested showed that the fracture behaviour is mainly influenced by the physical properties of the materials and not by the chemical properties of the phases present in the materials, for example, the binding of the large grains to the matrix.

6216 **(LA-UR—83-3169) Novel rf-plasma system for the synthesis of ultrafine, ultrapure SiC and Si_3N_4.** Vogt, G.J.; Hollabaugh, C.M.; Hull, D.E.; Newkirk, L.R.; Petrovic, J.J. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 19p. (CONF-831174—35). NTIS, PC A02/MF A01. Order Number DE84003774.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

A novel high-temperature plasma tube has been developed that overcomes the meltdown problem of the conventional water- and gas-cooled quartz plasma tubes commonly used. The key feature of this system is the placement of heavy-walled, water-cooled copper fingers inside a quartz mantle to shield the mantle from the intense radiation of the plasma. The copper fingers act as transformers to couple the plasma to the applied rf field. This system has been used to produce ultrafine, ultrapure silicon carbide powder by reaction of silane and methane. Powder of β-SiC has been obtained with a BET surface area of > 160 m^2/g and a particle size range of 10 to 20 nm. Likewise, powder of silicon nitride has been synthesized by reaction of silane and ammonia in the plasma. The resulting powder is approximately 50% Si_3N_4 with a mixture of α- and β-polymorphic forms. Boron carbide has also been successfully synthesized from diborane and methane.

6217 **(SAND—83-2362C) Thermal conductivity behavior of boron carbides.** Wood, C.; Zoltan, A.; Emin, D.; Gray, P.E. (Sandia National Labs., Albuquerque, NM (USA); Jet Propulsion Lab., Pasadena, CA (USA); GA Technologies, Inc., San Diego, CA (USA)). 1983. Contract AC04-76DP00789. 10p. (CONF-8310163—10). NTIS, PC A02/MF A01. Order Number DE84003208.

From 18. international thermal conductivity conference; Rapid City, SD, USA (3 Oct 1983).

Knowledge of the thermal conductivity of boron carbides is necessary to evaluate its potential for high temperature thermoelectric energy conversion applications. We have measured the thermal diffusivity of hot-pressed boron carbide B/sub 1-x/C/sub x/ samples as a function of composition ($0.1 \leqq x \leqq 0.2$), temperature (300 K to 1700 K) and temperature cycling. These data in concert with density and specific heat data yield the thermal conductivities of these materials. We discuss these results in terms of a structural model that has been previously advanced by two of us (DE and CW) to explain the electrical transport data. Some novel mechanisms for thermal conduction are briefly discussed.

6218 **(UCRL—89333) Dynamic consolidation of ceramic powders: practicalities, problems, and prospects.** Gourdin, W.H. (Lawrence Livermore National Lab., CA (USA)). 10 Nov 1983. Contract W-7405-ENG-48. 14p. (CONF-831174—41). NTIS, PC A02/MF A01. Order Number DE84003744.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

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I present an assessment of the technological potential of shock wave consolidation of ceramic powders as a technique for producing well-bonded, uniform, crack-free monoliths. Current compaction methods are briefly reviewed and the characteristics of the consolidated material are presented. The shock and release histories experienced by powder compacts in simple compaction as-

semblies are complex and I conclude that such simple assemblies are unlikely to yield structurally sound bodies. Control of the stress history over the entire loading cycle is necessary if the tensile stresses which develop during release are to be reduced to acceptable levels. Such exacting control is difficult to achieve, and becomes increasingly difficult as the peak stresses are increased. The powder must therefore be sufficiently plastic at moderate stresses to permit densification and bonding of the compact without destruction of the compact during release. Not all ceramic powders will satisfy this criterion. Local microstructural modification, including interfacial melting, is limited by the fine particle sizes and large surface areas of many ceramic powders. Production of cohesive, crack-free bodies thus depends upon a complex interplay between shock history, material properties, and powder characteristics which is poorly understood. I conclude that the technology of dynamic consolidation of ceramic powders will be difficult to develop and will have limited applications. 37 references, 8 figures.

6219 **Characterization of defects and inclusions in ceramic materials by means of high frequency ultrasonic waves.** Arnold, W.; Goebbels, K. pp vp of Jubilee meeting: 50 years of DGZfP. Non-destructive testing: Past, present, future. Abstracts. Berlin, Germany, F.R.; Deutsche Gesellschaft fuer Zerstoerungsfreie Pruefung e.V. (1983). (In German)(CONF-8305144—Absts.).

From Jubilee meeting: 50 years of DGZfP meeting on nondestructive testing: past, present, future; Berlin, F.R. Germany (8 May 1983).

6220 **Thermodynamics of carbon in Ni-C alloys from 900 to 1215°C.** Bradley, D.J. (Montana College of Mineral Science and Technology, Butte); Leitnaker, J.M.; Horne, F.H. *High Temperature Science;* **15**: No. 2/3, 187-198(1982). Contract W-7405-ENG-26.

The activity coefficient of carbon in nickel has been measured at 900, 1100, and 1215°C using the equilibrium $CH_4(g) = C(ss) + 2H_2(g)$. The activity coefficient is found to obey Henry's law up to the concentration investigated. Equations are presented for the partial molar mixing functions of carbon. The results are compared critically with those of earlier investigators.

6221 **Extrapolation of low temperature vapor pressure data of uranium carbide to the liquid region.** Tehranian, F.; Olander, D.R. (Lawrence Berkeley Lab., Univ. of California). *High Temperature Science;* **15**: No. 2/3, 239-247(1982). Contract AC03-76SF00098.

The thermochemical properties of liquid UC/sub 1+-y/ are estimated by extension of Nikol'skii's nonideal solution treatment of solid UC/sub 1+-y/. The connection between liquid and solid properties is made by the entropies of fusion of the pure components of the solution, U, UC, and UC_2. Agreement of the model predictions with earlier theory and experiment for the total pressure over UC(1) is good. The model also permits calculation of the partial pressures of all gaseous species in equilibrium with the nonstoichiometric liquid.

6222 **Grain-boundary-type Maxwell-Wagner peak in the thermally-stimulated depolarization of doped ceria ceramics.** Wang, D.Y.; Nowick, A.S. (Columbia Univ., New York). *Physica Status Solidi [Sectio] A: Applied Research;* **73**: 165-172(1982). Contract AC02-78ER04693.

A large peak in the thermally-stimulated depolarization current (TSDC) is observed for CeO_2 ceramics doped with cations of lower valence. The peak is shown to be a Maxwell-Wagner effect due to the presence of a high resistivity layer about grain boundaries, the same mechanism that gives rise to the grain boundary effect in the ac conductivity. This peak may be utilized to obtain values of the lattice ionic conductivity at temperatures well below those at which ac measurements can conveniently be made. It is also shown how to eliminate this peak in order to be able to study the much smaller peaks due to reorientation of dipolar defects.

6223 **Surface energies and surface structure of small crystals studied by use of a stem instrument.** Cowley, J.M. (Arizona State Univ., Tempe). *Surface Science;* **114**: 587-606(1982). Contract AC02-76ER02995.

The surfaces of small regularly-shaped crystals of MgO and NiO have been examined by use of a scanning transmission electron microscopy (STEM) instrument. Images of the surfaces obtained with diffracted electron beams show surface detail with high resolution. Microdiffraction patterns obtained with beams of 15 A diameter from small crystals having one flat face parallel to the beam show effects of the interactions of the electrons with the potential field of the crystal and of diffraction and channelling at the surface. Electron energy loss spectroscopy (ELS) of beams which have traversed flat surfaces of the crystals show energy losses due to the excitation of surface states and also energy losses associated with the generation of radiation as the electron beam enters and leaves the crystal potential field and as it is channelled along the surface by diffraction and refraction effects.

6224 **Influence of sputtering conditions on H content and Si-H bonding in a-Si:H alloys.** Martin, P.M.; Pawlewicz, W.T. (Pacific Northwest Lab., Richland, WA). *Journal of Non-Crystalline Solids;* **45**: 15-27(1981).

The influence of sputtering conditions on H concentration and Si-H bonding has been determined for the case of diode reactive sputtering of Si in Ar-H mixtures, and a simple model for Si-H reaction kinetics has been developed. H content and Si-H bonding can be varied and controlled over wide ranges by appropriate selection of sputtering conditions. Si-H reaction kinetics are found to be governed primarily by deposition rate (reaction time), H partial pressure (H availability) and possibly substrate temperature (mobility of Si and H on the surface of the growing film). H concentration increases with decreasing deposition rate and increasing H partial pressure. SiH bonding increases with increasing deposition rate and decreasing H partial pressure. Polymerization of H and Si (SiH_2, SiH_3) occurs for lowest deposition rates and highest H partial pressures. Polymerization reactions are enhanced in films deposited at very high target power densities. The high power density causes substrate temperature to be higher than expected, and the enhanced polymerization may be due to increased Si and H surface mobility at the elevated temperatures.

3604 Polymers And Plastics

REFER ALSO TO CITATION(S) 6724

6225 (INIS-mf—8672, pp 62) **Positron annihilation in γ-irradiated polymer polytetrafluorethylene samples of different degrees of crystallinity.** Kindl, P.; Sormann, H.; Puff, W. (Technische Univ., Graz (Austria). Inst. fuer Kernphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

3606 Other Materials

REFER ALSO TO CITATION(S) 5796, 5803, 5844, 6179, 6210, 6575

6226 (BDX—613-2991) **Effects of catalyst ratio and processing conditions on UCC/SE-54/497XL cellular silicone molding compound.** Sanders, R.S. (Bendix Corp., Kansas City, MO (USA)). Nov 1983. Contract AC04-76DP00613. 38p. NTIS, PC A03/MF A01. Order Number DE84004919.

The effects of heat strip time, heat strip temperature, catalyst ratio, mold cure time, post cure time, and post cure temperature on a hybrid (UCC/SE-54/497XL) cellular silicone molding compound are reported.

6227 (CONF-830711—7) **Comparison of the characteristics of graphites irradiated at 600 and 900°C.** Kennedy, C.R.; Eatherly, W.P.; Minderman, D. (Oak Ridge National Lab., TN (USA); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). 1983. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE83015695.

From 16. American Carbon Society biennial conference; La Jolla, CA, USA (17 Jul 1983).

Graphite for the reflector in the pebble-bed High-Temperature Reactor in the Federal Republic of Germany (FRG) requires exceptional irradiation resistance for economic viability. The candidate graphites are being irradiated in the High Flux Isotope Reactor (HFIR) at Oak Ridge to assess their irradiation life expectancy. This assessment is based upon dimensional stability, elastic constants from sonic testing, electrical resistivity from eddy-current testing, coefficient of thermal expansion, and brittle-ring fracture testing. To date 13 FRG grades have been irradiated and compared with four graphites made in the United States and one from the United Kingdom. The irradiation temperatures were 620, 715, and 900°C.

6228 **(CONF-831174—23) Influence of cation stoichiometry on the electrical conductivity and high-temperature stability of $MgO:nAl_2O_3$ spinel.** Sonder, E.; Darken, L.S. (Oak Ridge National Lab., TN (USA)). Nov 1983. Contract W-7405-ENG-26. 7p. NTIS, PC A02/MF A01. Order Number DE84003305.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

The electrical conductivity of $MgO:nAl_2O_3$ spinel has been measured for $1 < n < 3.6$ for temperatures between 500 and 1400°C. The results for nonstoichiometric spinel are significantly different from those of stoichiometric material. Spinel with n up to 2 was found to be stable at temperatures above 1000°C, whereas, $MgO:3.6Al_2O_3$ exhibited multiple indications of instability and disproportionation.

6229 **(CONF-831187—13) Crystal fields and second order magnetic hyperfine interactions in $TmFe_2Si_2$.** Umarji, A.M.; Shenoy, G.K.; Noakes, D.R.; Dattagupta, S. (Argonne National Lab., IL (USA); Hyderabad Univ. (India). School of Physics). Sep 1983. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01. Order Number DE84003622.

From MMM conference; Pittsburgh, PA, USA (8 Nov 1983).

We report the measurement of Moessbauer hyperfine spectra of $TmFe_2Si_2$ using the 8.4 keV transition in ^{169}Tm. The detailed temperature dependence of the quadrupole interaction has permitted us to evaluate the crystalline electric fields (CEF) acting on Tm atom. The analysis indicates the ground state of Tm to be a singlet state. However, the hyperfine coupling of the ^{169}Tm with the excited CEF states generates a second order magnetic hyperfine interaction which has been observed in our experiment. An account of the spin relaxation of the second order magnetic hyperfine interaction is presented.

6230 **(CONF-831187—16) Small-angle neutron scattering of $DyMo_6S_8$ at low temperature.** Lander, G.H.; Pynn, R.; Ishikawa, M. (Institut Max von Laue - Paul Langevin, 38 - Grenoble (France); Geneva Univ. (Switzerland)). 1983. Contract W-31-109-ENG-38. 10p. NTIS, PC A02/MF A01. Order Number DE84003674.

From MMM conference; Pittsburgh, PA, USA (8 Nov 1983).

The Chevrel phase compound $DyMo_6S_8$ becomes superconducting at 2.05 K and an antiferromagnetic (AFM) T/sub M/ = 0.4 K. Experiments with an applied magnetic field have shown that the AFM state is gradually suppressed and a ferromagnetic component seems to be induced before H/sub c2/ (1200 0e) is reached. The present experiments have been performed at the small-angle scattering facility D11 at the Institut Laue Langevin with a dilution refrigerator and applied fields of up to 2000 0e. Neutron wavelengths of 6.25 and 10A have been used allowing a minimum wavevector Q/sub min/ $\approx$ 0.005 A^{-1} to be achieved. For increasing H we find a sudden increase in the small-angle scattering at H = 180 0e, which we identify as H/sub c1/. With a position sensitive detector we have also investigated the scattering as a function of the relative orientation of Q Vector and H Vector. For a simple paramagnet we would expect more magnetic intensity with Q Vector perpendicular H Vector than with Q Vector parallel H Vector, however, we find the exact reverse with somewhat more intensity for Q Vector parallel H Vector. This is not understood, but we propose that the small-angle scattering is predominantly inelastic. Similar anisotropic effects have been found in other Chevrel phase systems. 7 references.

6231 **(DOE/ER/01198—T3) Intercalate phonon densities of states for alkali-graphite compounds.** Kamitakahara, W.A.; Zabel, H. (Ames Lab., IA (USA); Illinois Univ., Urbana (USA)). 1982. Contract AC02-76ER01198. 5p. (CONF-821185—4). NTIS, PC A02/MF A01. Order Number DE83003911.

From Materials Research Society annual meeting; Boston, MA, USA (16 Nov 1982).

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Neutron scattering methods have been used to determine the partial phonon densities of states g/sub M/(nu) for inplane vibrations of M atoms in MC/sub x/ compounds, where M = K, Rb or Cs, and x = 8, 24, 36. Only modes with both phonon wave vectors and displacements in the basal plane are represented in g/sub M/(nu). Detailed measurements of the temperature dependence were made for RbC_{24} and KC_{24}, in order to study the influence of the order-disorder transformations in these compounds. The results are interpreted in terms of different pictures of the disordered state.

6232 **(DOE/ER/01198—T4) Diffusive motion of alkali atoms in graphite: a quasielastic neutron-scattering study.** Zabel, H.; Magerl, A.; Rush, J.J.; Dianoux, A.J. (Illinois Univ., Urbana (USA); Institut Max von Laue - Paul Langevin, 38 - Grenoble (France); National Measurement Lab. (NBS), Washington, DC (USA)). 1982. Contract AC02-76ER01198. 3p. (CONF-821185—5). NTIS, PC A02/MF A01. Order Number DE83003912.

From Materials Research Society annual meeting; Boston, MA, USA (16 Nov 1982).

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We have studied the diffusive motion of alkali atoms in thermodynamic equilibrium in RbC_{24} by quasielastic neutron scattering. The neuton spectra show Lorentzian line profiles. The widths increase with increasing temperature. In addition a de Gennes narrowing is observed at Q=1.2, which coincides with the first peak in the intercalant structure factor. The narrowing becomes more pronounced at higher temperatures in contrast to a normal liquid. The data can be interpreted by the motion of clusters of alkali atoms rather than by a liquid type motion. This adds a dynamical aspect to the floating solid as described by Nelson and Halperin for the melting of a 2-dimensional solid.

6233 **(DOE/ER/01198—T5) Binary and ternary alkali graphite intercalation compounds: in-situ x-study of elastic and electrostatic effects on staging.** Misenheimer, M.E.; Chow, P.; Zabel, H. (Illinois Univ., Urbana (USA)). 1982. Contract AC02-76ER01198. 6p. (CONF-821185—3). NTIS, PC A02/MF A01. Order Number DE83003913.

From Materials Research Society annual meeting; Boston, MA, USA (16 Nov 1982).

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We have studied stage transformations of binary potassium-graphite intercalation compounds by in-situ x-ray (00l) scans. In the transition region of stages one and two both stages coexist and all Bragg reflections exhibit resolution limited widths. The characteristics of the stage transformation are identical in intercalated HOPG and single crystals. This implies that the stage transformation is a direct process with no need of forming intermediate structures, favoring electrostatic interaction as the dominant stabilizer for pure stage donor compounds. We have also studied the elastic distortion due to potassium atoms substitutional dissolved in rubidium intercalant layers. From the interlayer spacing variation we find a double force tensor P/sub zz/ = 0.36 eV for potassium defects in RbC_8 in the small defect concentration region.

6234 **(DOE/ER/10896—3) Thermal expansion effects in cordierite. Technical progress report, November 1, 1982-December 1, 1983.** Predecki, P.K. (Denver Univ., CO (USA)). Dec 1983. Contract AC02-81ER10896. 13p. NTIS, PC A02/MF A01. Order Number DE84004045.

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During this time period, modifications to the Huber-Guinier system were largely completed. Lattice thermal expansion data were obtained on cordierite samples doped with Li^{+1}, Be^{+2}, Be^{+3}, P^{+5}, Ca^{+2}, Zn^{+2}, Ge^{+4} at the 1% and 5% level. The a-axis thermal expansion was mostly linear with temperature and relatively insen-

sitive to dopant type and level. The c-axis thermal expansion showed marked nonlinearities and trend reversals with temperature and dopant level. No obvious correlations were found between the expansion data and either ion size charge or the room temperature lattice parameters. The largest decrease in overall c-axis thermal expansion was shown by Li^{+1} at the 5% level and the largest initial decrease in c-axis expansion by Ca^{+2} at the 1% level.

6235 (INIS-mf—8295) **Superconductivity in lanthanum chalcogenides under pressure.** Eiling, A. (Bochum Univ. (Germany, F.R.). Abt. Physik und Astronomie). 14 Jan 1981. 104p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84700522.

In this thesis the pressure dependence of the superconducting transition temperature of La_3S_4, La_3Se_4, La_3Te_4, $La_3Se_2S_2$, and La_3Sesub(3,6) Tesub(0,4) is investigated up to 4,5 GPa. A pressure cell is reported which allows also the measurement of the magnetic susceptibility under pressure. The calculated density of states describe the increase of the critical temperature very well in the frame of Mc Millans equation.

6236 (INIS-mf—8536, pp 35) **Transfer annealing: is the doping procedure really important.** Collins, C.H.; Collins, K.E.; De Andrade, J.C.; Yoshikawa, O.A.E.; Lancas, F.M. (Universidade Estadual de Campinas (Brazil). Inst. de Quimica). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).

Published in summary form only.

6237 (INIS-mf—8536, pp 36) **Transfer annealing of $^{51}Cr(III)$-Dopant in K_2SO_4.** Collins, C.H.; Manfredi, J.F.; Collins, K.E. (Universidade Estadual de Campinas (Brazil). Inst. de Quimica). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).

Published in summary form only.

6238 (INIS-mf—8672, pp 74) **Brillouin scattering experiment to determine the temperature dependence of mean free path in liquid CCl_4.** Sedlacek, M.; Woehrl, M. (Vienna Univ. (Austria). Inst. fuer Experimentalphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6239 (INIS-mf—8672, pp 38) **Determination of work functions difference between PbTe and PbSnTe by a Kelvin vibrating reed electrometer.** Ambrosch, K.-E.; Clemens, H. (Montanistische Hochschule, Leoben (Austria). Inst. fuer Physik); Winkler, A. (Technische Univ., Graz (Austria). Inst. fuer Festkoerperphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6240 (INIS-mf—8672, pp 44) **Conductivity, magnetic susceptibility and Fe^{57} Moessbauer spectroscopic investigations of (Me, Nb)Nb_3Se_{10} with Me = Fe,Cr and (Fe,Ta)Nb_2Se_{10}.** Gruber, H. (Tehnische Univ., Graz (Austria). Inst. fuer Festkoerperphysik); Sitte, W. (Technische Univ., Graz (Austria). Inst. fuer Physikalische und Theoretische Chemie); Steiner, W. (Technische Univ., Vienna (Austria). Inst. fuer Angewandte und Technische Physik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6241 (INIS-mf—8672, pp 50) **Microwave harmonics mixing in $NbSe_3$.** Mayr, W.; Philipp, A.; Seeger, K. (Vienna Univ. (Austria). Inst. fuer Festkoerperphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6242 (INIS-mf—8672, pp 33) **Microscopic identification of deep defects in CdTe.** Brunthaler, G.; Jantsch, W. (Johannes Kepler Univ., Linz (Austria). Inst. fuer Experimentalphysik); Kaufmann, U.; Schneider, J. (IAF, Freiburg (Germany, F.R.)). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6243 (INIS-mf—8672, pp 34) **Mechanical stresses in PbTe-PbSnTe superlattices.** Clemens, H.; Ambrosch, K.E.; Fantner, E.J.; Bauer, G. (Montanistische Hochschule, Leoben (Austria). Inst. fuer Physik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6244 (INIS-mf—8672, pp 36) **Magneto-optical investigations of deep defects in PbTe.** Niewodniczanska-Zawadzka, J.; Lischka, K. (Johannes Kepler Univ., Linz (Austria). Inst. fuer Experimentalphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6245 (INIS-mf—8672, pp 39) **Photoluminescence investigations on CdS epitaxial layers.** Humenberger, J.; Linnert, G. (Johannes Kepler Univ., Linz (Austria). Inst. fuer Experimentalphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6246 (INIS-SU—196, pp 43-45) **Relativistic electron radiation spectra in silicon monocrystal.** Ganenko, V.B.; Miroshnichenko, I.I.; Pegushin, E.V.; Sanin, V.M.; Shalatskij, S.V. 1982. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8105209—No.1(19)).

From All-union seminar electromagnetic interactions of hadrons in the resonance energy range; Khar'kov, Ukrainian SSR (26 May 1981).

Measurements of spectral distributions of gamma-radiation intensity of 1.2 GeV electrons moving through 0.24 mm thick silicon monocrystal in the mode of axial and planar channeling (axis $< 110 >$, plane (001)) are conducted. Radiation intensity in the distribution maximum 17 times exceeds the radiation intensity of electrons in an amorphous target of equivalent thickness.

6247 (SAND—83-1440C) **Line-source E-beam crystallization of silicon-on-insulator films.** Knapp, J.A.; Picraux, S.T. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 8p. (CONF-831174—37). NTIS, PC A02/MF A01. Order Number DE84003218.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

Silicon-on-insulator films have been formed using a 20 mm by 1 mm line-source electron beam, with sample sweep speeds of 100 to 500 cm/sec and peak beam power densities up to 75 kW/cm^2. Films were formed over 1 and 2 μm thick SiO_2 isolating layers on 4 in. diameter Si<100> wafers, with stripe openings of 5 to 100 μm width for seeding the crystallization from the substrate. Films consisted of Si layers from 0.4 to 1.0 μm thickness, with a capping layer of 2 μm SiO_2. By sweeping the beam parallel to the long axis of the seed openings, smooth, oriented films were obtained, with low-angle grain boundaries confined to midway be-

tween seed openings. Best results were obtained for ≦ 50 μm spacing between seed openings.

6248 **(SAND—83-1647C) Refractory materials for high-temperature thermoelectric energy conversion.** Wood, C.; Emin, D. (Jet Propulsion Lab., Pasadena, CA (USA); Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 8p. (CONF-831174—46). NTIS, PC A02/MF A01. Order Number DE84004994.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

Theoretical work of two decades ago adequately explained the transport behavior and effectively guided the development of thermoelectric materials of high conversion efficiencies of conventional semiconductors (e.g., SiGe alloys). The more significant contributions involved the estimation of optimum doping concentrations, the reduction of thermal conductivity by solid solution doping and the development of a variety of materials with ZT ~ 1 in the temperature range 300 K to 1200 K. It was also shown that ZT ~ 1 is not a theoretical limitation although, experimentally, values in excess of one were not achieved. Work has continued with emphasis on higher temperature energy conversion. A number of promising materials have been discovered in which it appears that ZT > 1 is realizable. These materials can be divided into two classes: (i) the rare-earth chalcogenides, which behave as itinerant highly-degenerate n-type semiconductors at room-temperature, and (ii) the boron-rich borides, which exhibit p-type small-polaronic hopping conductivity.

6249 **(SAND—83-2004) Dynamic fragmentation of ferroelectric ceramics using the torsional Kolsky bar.** Costin, L.S.; Grady, D.E. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1983. Contract AC04-76DP00789. 33p. NTIS, PC A03/MF A01. Order Number DE84003726.

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This paper studied the dynamic loading and subsequent fragmentation of four different load zirconate titanate (95/5 PZT) ferroelectric ceramics using a torsional Kolsky bar apparatus. Solid cylinders of the four materials were loaded in torsion at shear strain rates in the range 10^2 to $10^3 s^{-1}$. Using the strain gage recordings of the incident, reflected and transmitted pulses, the energy required to fragment the specimen was determined for each test. In addition, the fragments resulting from each test were collected and analyzed by various technciques to determine their mass and size distributions. Results show some differences in particle distributions between the different batches of material. However, there is a more significant and consistent difference between the dynamic strength (as measured by the maximum shear stress) and the fragment mass distributions of the virgin material and the pressure depoled material, despite the fact that no differences were detected in the energy of fragmentation. Using earlier analytical results which relate the local kinetic energy of a potential fragment to the surface energy required to create that fragment, a relationship between the distribution of fragments from a test and material properties was derived. Results of tests on PZT as well as other materials such as oil shale, graphite, uranium dioxide and glass indicate a good correlation between the fragment distribution parameter, n, and material properties as predicted by the theory. Finally, the results are analyzed to determine the potential effects of internal stresses on the dynamic strength of the material and its fragmentation characteristics.

6250 **Magnetic susceptibility of Stycast 1266 epoxy.** Azevedo, L.J. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Review of Scientific Instruments;* **54**: No. 12, 1793(Dec 1983). Contract AC04-76DP00789.

The magnetic susceptibility of Stycast 1266 epoxy, a commonly used low-temperature material, has been measured from 2.5 to 400 K. The susceptibility is diamagnetic over the entire temperature range studied with a small Curie contribution at low temperatures.

6251 **Studies of the spectral and spatial characteristics of shock-induced luminescence from x-cut quartz.** Brannon, P.J.; Konrad, C.; Morris, R.W.; Jones, E.D.; Asay, J.R. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Applied Physics;* **54**: No. 11, 6374-6381(Nov 1983). Contract AC04-76DP00789.

Spatial and spectral studies of shock-induced luminescence from x-cut crystalline quartz as a function of stress level revealed the following information: Crystalline x-cut quartz has a threshold for emission near the dynamic yield point (about 6 GPa); the spatial distribution of the luminescence from x-cut quartz changes from an intersecting linear emission pattern to a uniform emission pattern as the stress level increases from 6 to 8 GPa; spectra from x-cut quartz are band-like rather than blackbody; crystalline x-cut quartz has emission peaks near 400 and 600 nm; a change in the 400-nm emission with time can be correlated to wave interaction times. A discussion of the luminous emission in terms of yielding and other physical mechanisms is given.

6252 **Space-charge-limited currents: Refinements in analysis and applications to a-Si/sub 1-x/Ge/sub x/:H alloys.** Weisfield, R.L. (Gordon McKay Laboratory, Harvard University, Cambridge, Massachusetts 02138). *Journal of Applied Physics;* **54**: No. 11, 6401-6416(Nov 1983). Contract AC02-77CH00178.

A new algorithm is described for deriving the density of states N(E) from the Fermi energy E/sub F/ upwards toward the conduction band edge. This refinement in the analysis of space-charge-limited currents (SCLC) enables the accurate determination of N(E) by implicitly accounting for the spatial variations of physical quantities across the thickness of the diode. SCLC is measured in NiCr/n^+/a-Si/sub 1-x/Ge/sub x/:H/Pt diode structures. For a-Si:H samples, SCLC values for N(E/sub F/) are compared to those derived from admittance measurements on the same diodes. The two determinations agree in samples where $10^{16} < N(E/\text{sub } F/) < 10^{18}$ eV^{-1} cm^{-3}. Arguments are presented that densities of states between 3 x 10^{14} and 10^{16} eV^{-1} cm^{-3} found by SCLC methods are more accurate than higher densities found from admittance measurements. Structure in N(E) inferred from a number of investigations is discussed. SCLC in sputtered a-Si/sub 0.7/Ge/sub 0.3/:H is also investigated, as a function of hydrogen content c/sub H/, optical gap, and photoluminescence intensity I/sub PL/. In this alloy increasing c/sub H/ causes N(E/sub F/) to decrease, to a minimum of 3 x 10^{16} for c/sub H/ = 14 at. %. I/sub PL/ increases inversely with N(E/sub F/), confirming the sensitivity of SCLC to bulk nonradiative recombination centers.

6253 **de Haas—van Alphen measurements in the ferromagnetic compounds U_3P_4 and U_3As_4.** Henkie, Z.; Johanson, W.R.; Arko, A.J.; Crabtree, G.W.; Bazan, C. (Institute for Low Temperature and Structural Research, Polish Academy of Sciences, PL-50-950 Wroclaw, Poland). *Physical Review [Section] B: Condensed Matter;* **28**: No. 8, 4198-4203(15 Oct 1983).

de Haas—van Alphen measurements are reported for the ferromagnetic actinide compounds U_3P_4 and U_3As_4. The large effective masses indicate f-electron interaction with conduction bands. The data are interpreted in terms of a semimetallic band structure producing a large electron sheet at point Γ which is compensated by several smaller hole pockets along the Γ—P line. The measured internal field is much smaller than expected on the basis of magnetization measurements. Several discrepancies with other measurements point to additional unobserved pieces of the Fermi surface.

6254 **Photoluminescence in semimagnetic Zn/sub 1-x/Mn/sub x/Te.** Gal, M.; Hefetz, Y.; Ajo, J.K.; Nurmikko, A.V. (Division of Engineering, Brown University, Providence, Rhode Island 02912). *Physical Review [Section] B: Condensed Matter;* **28**: No. 8, 4500-4505(15 Oct 1983). Contract AC02-81ER10877.

Luminescence in photoexcited Zn/sub 1-x/Mn/sub x/Te has been studied for three dilute alloy compositions (x = 0.001, 0.011, and 0.016) under a wide range of excitation and in zero external magnetic field. We find that the bound-exciton localization energy is composition dependent, evidently due to an exchange-induced contribution by the paramagnetic Mn ions. Under high-intensity excitation we have observed electron-hole plasma (EHP) emission from all the samples studied. For the line-shape analysis of the EHP emission, a simple model is introduced that takes alloy-compositional fluctuations into account. The EHP emission for the x =

0.001 material yields plasma parameters which are consistent with the formation of an electron-hole liquid, while in samples with higher Mn concentration there is no evidence for such formation.

6255 **Comparative studies of electronic structures of sodium metasilicate and α and β phases of sodium disilicate.** Ching, W.Y.; Murray, R.A.; Lam, D.J.; Veal, B.W. (Department of Physics, University of Missouri-Kansas City, Kansas City, Missouri 64110). *Physical Review [Section] B: Condensed Matter;* **28**: No. 8, 4724-4735(15 Oct 1983).

The electronic structures of sodium metasilicate (Na_2SiO_3) and the α and β phases of sodium disilicate ($Na_2Si_2O_5$) are calculated from first principles by the method of linear combination of atomic orbitals. Two different sets of calculations with exchange parameter α set equal to (2/3) and 1.0 were performed. Results are presented in terms of total and partial density of states and the valence electron charge distribution. The calculated electronic structures are discussed in connection with the local structural environment of each type of atom in these crystals. Comparison with experimental x-ray photoelectron spectra on (Na_2O)/sub x/(SiO_2)/sub 1-x/ glasses suggests that local short-range order in crystalline and glassy alkali silicates is similar.

6256 **Electronic band structures for zinc-blende and wurtzite CdS.** Chang, K.J.; Froyen, S.; Cohen, M.L. (Department of Physics, University of California, Berkeley, California 94720 and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review [Section] B: Condensed Matter;* **28**: No. 8, 4736-4743(15 Oct 1983).

The electronic band structures for zinc-blende and wurtzite CdS are calculated within the local-density approximation with the use of first-principles pseudopotentials. Incorporating the d state into the valence band improves substantially the main-valence-band width, and yields valence-band features in good agreement with experiment. The maximum effect of the d band occurs at Γ_{15} for zinc-blende CdS and at Γ_1,Γ_6 for wurtzite CdS. We find that the local-density approximation does not predict accurately the position of localized Cd 4d state.

6257 **Auger decay mechanism in photon-stimulated desorption from sodium fluoride.** Parks, C.C.; Hussain, Z.; Shirley, D.A.; Knotek, M.L.; Loubriel, G.; Rosenberg, R.A. (Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720 and Department of Chemistry, University of California, Berkeley, California 94720). *Physical Review [Section] B: Condensed Matter;* **28**: No. 8, 4793-4798(15 Oct 1983).

Photon-stimulated desorption of Na^+ and F^+ occurs from a NaF(100) cleaved surface upon Na(1s) excitation. These measurements represent the first observation of metal-cation desorption following metal-cation—core excitation. In agreement with the Auger decay model of desorption, both sodium and fluorine positive-ion yields (versus photon energy) are similar to total electron yield in the vicinity of the Na K edge, except for a pre-edge peak observed predominantly in Na^+ desorption. Intra-atomic Auger decay of the Na(1s) core hole followed by charge transfer from adjacent halogens is shown to initiate desorption. The resulting neutral or positively charged halogens provide the driving force for desorption of sodium ions from the surface. Expressions are developed for the maximal energy available to the desorbing Na^+ or F^+ ions.

6258 **Solid-phase-epitaxial growth and formation of metastable alloys in ion implanted silicon.** Narayan, J.; Holland, O.W.; Appleton, B.R. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Journal of Vacuum Science and Technology, B: Microelectronics Processing and Phenomena;* **1**: No. 4, 871-887(Oct 1983). Contract W-7405-ENG-26.

Transmission electron microscopy (cross-section and plan-view) and ion backscattering techniques have been combined to study the details of solid-phase-epitaxial (SPE) growth in Sb^+, In^+, Bi^+, Ga^+, and As^+ implanted silicon after furnace annealing in the temperature range 450 to 650 °C. The ion implanted amorphous layer grew "defect-free" in <001> orientations and the crystalline—amorphous (c—a) interface during growth contained undulations ~5 A over the intervals of 200—500 A. During SPE growth in <111> orientations, the c—a interface was atomically smooth initially, but eventually became nonplanar due to the formation of twins. From SPE growth rates at different temperatures, the activation energy associated with the growth was determined to be 2.6 +- 0.3 eV. The dopant concentrations in defect-free SPE grown layers were found to exceed equilibrium solid solubility limits by as much as a factor of 560 in the Si—Bi system. The absolute maximum concentrations, corresponding to the intersections of free-energy versus composition curves of amorphous and crystalline silicon, were calculated and the results were compared with the observed concentrations. The observed concentrations, which were found to depend upon the amorphous state or free energy of as-implanted silicon, approached the calculated limits in the case of the Si—Sb and Si—As systems. However, for the Si—In, Si—Ga, and Si—Bi systems, interfacial segregation and solute redistribution during SPE growth prevented the maximum achievable concentrations.

6259 **Study of the stepwise oxidation and nitridation of Si(111): Electron stimulated desorption, Auger spectroscopy, and electron loss spectroscopy.** Knotek, M.L.; Houston, J.E. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Vacuum Science and Technology, B: Microelectronics Processing and Phenomena;* **1**: No. 4, 899-914(Oct 1983). Contract AC04-76DP00789.

Electron stimulated desorption, Auger line shape analysis, and electron loss spectroscopy measurements are reported for the electron activated stepwise oxidation and nitridation of the Si(111) surface. In ESD it is found that appreciable levels of surface hydrogen can be present which can lead to hydroxyl formation upon oxidation. The hydroxyl rich films are unstable in an electron beam, while surfaces oxidized with activated oxygen, where no OH is formed, are much more stable. The nitrided films are always stable in the electron beam even though there too hydrogen is always found. On the OH-free oxide, ESD shows two chemically distinct O species, one thought to be SiO_2 and the other adsorbed O_2 or a chemical intermediate. The Si(L_{23}VV) Auger spectra for both the oxide and nitride are treated by background subtraction, integration, deconvolution, and subtraction of the elemental part of the spectrum, as a function of reaction time over a well controlled series of reaction steps. The Auger spectra for both oxide and nitride films suggest that in the earliest stages of reaction, the reacted film is made up of low coordination intermediates which gradually evolve to the stoichiometric compound as the coordination increases. In loss spectroscopy, both the Si(L_{23}) core loss and the near elastic loss were measured. The L_{23} core loss shows the same gradual evolution to the oxide seen in the Auger results, with an intermediate oxidation state dominating in the early stages of reaction. The near elastic loss spectra, by contrast, quickly saturate in the early stages of reaction to the final oxide spectrum which is characterized by features both of the full oxide and a suboxide. Similar results are found for the nitride.

6260 **Photoacoustic spectra of MoS_2.** Carlson, K.D.; Hodul, D. (Argonne National Laboratory, Argonne, Illinois 60439). *Applied Optics;* **22**: No. 18, 2893-2896(15 Sep 1983). Contract W-31-109-ENG-38.

The photoacoustic spectra of powdered MoS_2 prepared by particle-size reduction and dilution have been determined and compared with the optical transmittance spectra of single crystals and thin-film deposits. MoS_2 was chosen as a typical representative of the layer-structured transition metal dichalcogenides, for which optical properties are important in explaining their unusual structural and transport properties. Reasonably well-resolved photoacoustic spectra were obtained by a layering technique using KCl as a diluent. Analysis of the experiments indicated that the spectral resolution was obtained not by reduction in photoacoustic signal saturation but by the enhancement of diffuse reflectance.

6261 **Optical studies of color centers in $LiYF_4:Nd^{3+}$ crystals.** Macedo, T.C.A. Sao Paulo, Brazil; Instituto de Pesquisas Energeticas e Nucleares (1982). 106p. (In Portuguese). IPEN, Sao Paulo, Brazil.

The synthetic monocrystal of the structure scheelite, $LiYF_4$, doped with rare-earth ions, thrice ionized, Nd^{3+}, was submitted to radiation-X at room temperature. The damage produced by the radiation was studied by techniques of optic spectrograph of absorption and emission. The band of optic absorption centered in 3.70 eV is proposed as being due to the Center F (electron imprisoned in the vacancy of the fluorine ion), not presenting dislocation of energy with the polarization of the light, thus indicating a configuration of high spacial symmetry. Through a cryogenic system it was possible to verify the dependence of the profile of this band of absorption with the temperature. Up to temperatures on the order of 200 K, this band can be adjusted to one gauss indicating a strong interaction electron-phonon of the electron imprisoned in this color center. A strong resemblance with the optic spectrum of absorption of four bands of the CaF_2, doped with rare-earth ions or Yttrium was observed. To analyze the photochromic conduct of this monocrystal, irradiations with ultraviolete light were realized, verifying the reversible character of these centers. Through this experiment, the dependence of the transition ^4D sub (3/2) of the ion Nd^{3+} with the band centered in 4.57 eV was verified. This band was identified as being due to the Center PC (photochromic center). The phosphoresecence of the sample was measured after the irradiation-X, identifying it as being due to the ions Nd^{3+}. (Author).

6262 **Ion exchange properties of complex cyanoferrates.** Shahbandeh, M.R. London, England; London University (1980). 171p. British Library, Boston Spa, Wetherby, West Yorks. No. D70004/81.

Thesis.

The preparation and properties of the mixed cyanoferrate (II) complexes of the alkali and transition metals have been investigated. One of the compounds, sodium-copper cyanoferrate (II) was selected for a thorough investigation because of its favourable properties for the removal of caesium ions from low and medium active waste solutions. The significance of various steps in the preparation of sodium-copper cyanoferrate(II), and their effects on the properties of the final product are studied. X-Ray diffraction patterns before and after incorporation of the caesium ions show changes in the intensities of the reflections and structural analysis suggests a defect lattice structure with a face centred cubic unit cell belonging to the high symmetry space group Fm3m. 33% of the corner sites are vacant in the sodium compound. In the caesium compound this proportion rises to 43%. Moessbauer spectroscopy of the copper-cyano ferrate complexes of Li, Na, K, Rb and Cs shows an increase in the isomer shift from Li to Cs and suggests that up-take of caesium by sodium-copper cyanoferrate (II) is not a simple ion-exchange process. Small-scale column experiments have been performed and breakthrough curves have been obtained under different operating conditions. The column behaviour of this adsorber during the early stages of the adsorption process can be predicted by assuming a reversible second order rate expression.

6263 **(PNL-tr—436) Crystal structure of α-$Fe_2(CrO_4)_3.3H_2O$.** Riou, A.; Bonnin, A. Translated from *Acta Crystallographica, Section B: Structural Crystallography and Crystal Chemistry ;* 34: 706-709(1978). Contract AC06-76RL01830. 13p. NTIS, PC A02/MF A01. Order Number DE84001199. DE84001199

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$\alpha Fe_2(CrO_4)_3.3H_2O$ has been studied by single-crystal x-ray structural analysis. It crystallizes in the centro symmetric, monoclinic space group $P2_1/c$, with α = 15.802 (7), b = 5.436 (4), c = 14.603 (7) A, β 108.13(4)°, V = 1192 (2) A^3, D/sub m/ = 2.89 (1), D/sub c/ = 2.862 (5) g cm^3 for M/sub r/ = 510.69 and Z = 4. Diffraction data were collected mainly on a Weissenberg integrating camera and the structure was solved by Patterson, Fourier, and least-squares refinement techniques. All atoms, except the water H atoms, were located, the final discrepancy index being R/sub hkl/ = 6.99 for the 805 reliable reflections. The underlying structural component for $\alpha Fe_2(CrO_4)_3.3H_2O$ is a compact sheet of composition $[Fe(CrO_4)_2]$/sub n//sup n/ oriented parallel to the (100) plane and located at x = 0. All these sheets are connected by $[Fe(CrO_4)(H_2O)_3]$/sub n//sup n^+/ chains oriented parallel to the [010] axis. The sheet is built of $[Fe(1)O_6]$ octahedra and $[CrO_4]$ tetrahedra, whereas the chain is characterized by the presence of $[Fe(2)O_2(H_2O)_3]$ octahedra.

40 CHEMISTRY

6264 **2. International symposium on homogeneous catalysis. Abstracts of papers.** Frankfurt am Main, Germany, F.R.; Gesellschaft Deutscher Chemiker (1980). 199p. Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe (Germany, F.R.).

From 2. international symposium on homogeneous catalysis and 27. event of FECS; Duesseldorf, F.R. Germany (1 Sep 1980).

Individual items in scope for the data base are processed separately.

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 5696, 5771, 5776, 5776, 5777, 5779, 5815, 5816, 5817, 5826, 6302, 6344, 6651

6265 **(CONF-830633—7) Investigations of ion-size-selective synergism in solvent extraction.** McDowell, W.J.; Case, G.N.; Aldrup, D.W. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 29p. NTIS, PC A03/MF A01. Order Number DE84003168.

From 3. symposium on separation science and technology for energy applications; Gatlinburg, TN, USA (27 Jun 1983).

Organophilic crown ethers and other similar macrocyclic compounds produce a synergistic enhancement of the extraction of several metal ions by organic-phase-soluble carboxylic, phosphoric, and sulfonic acids. Ions examined include the alkali metals, the alkaline earths, and some first-row transition elements. In many cases, the synergistic effects are clearly related to the correspondence of the ion size to the macrocycle cavity diameter. In other cases this is less true, and occasionally, complete lack of synergism or even antagonism is observed. These phenomena have been investigated by systematic studies of the systems involved, by equilibrium studies of selected extraction systems, and by vapor-pressure osmometric studies of the intermolecular bonding between the organic-phase macrocycles and acids. Lack of synergism (when it is expected from size correspondence) does not appear to be due to bonding interactions between the macrocycle and the extractant acid. Other considerations suggest that synergism may depend on the degree to which the macrocycle can surround the ion. Possibilities for metal ion separations are noted, and the directions for further, needed investigations are indicated.

6266 **(DOE/ER/10622—4) Absorption and desorption of hydrocarbons at low concentrations. Progress report, January 1-November 30, 1983.** Madey, R. (Kent State Univ., OH (USA)). 30 Nov 1983. Contract AC02-80ER10622. 18p. NTIS, PC A02/MF A01. Order Number DE84003170.

Research accomplishments during the report period include the following: development of a mathematical model for a linear nonequilibrium chromatographic reactor with a first-order chemical reaction; development of a separation factor method for the analysis of ideal binary mixtures in gas-solid adsorption; applications of ideal adsorbed solution theory to the adsorption of binary mixtures of ethane and acetylene on activated carbon; studies of the adsorption isotherms and the isosteric heats of adsorption of ethane, propane, and n-butane on polystyrene at 0, 25, and 30°C; and studies of the adsorption of binary mixtures of n-butane and propane on polystyrene at 0 and 25°C; studies of the adsorption isotherms of other gases on polystyrene at 0, 25, and 30°C; and preparation of a bibliography of experimental data and theoretical treatments of dynamic adsorption of multicomponent mixtures.

6267 **(DOE/PC/40809—20) Capillary supercritical fluid chromatography of polycyclic aromatic compounds.** Jackson, W.P.; Kong, R.C.; Lee, M.L. (Brigham Young Univ., Provo, UT (USA). Dept. of Chemistry). 1983. Contract FG22-81PC40809. 18p. (CONF-8310179—4). NTIS, PC A02/MF A01. Order Number DE84002939.

From 8. international symposium on polynuclear aromatic hydrocarbons; Columbus, OH, USA (26 Oct 1983).

Portions are illegible in microfiche products.

The use of modifiers in supercritical n-pentane for the analysis of high molecular weight PAH is described. Density meas-

urements were taken of the n-pentane/modifier supercritical fluid mixtures in order to empirically establish the pressure versus density isotherms of these mixed supercritical fluids. The effects of these mixed phases on retention of PAH solutes were then examined and compared. Finally, the ability of SFC to analyze real samples of high molecular weight PAH is shown.

6268 (INIS-BR—77) **Application of Auger electron spectroscopy in studies about diffusion of Cu in thin Ni films.** Achete, C.A.; Losch, W.H.P. (Rio de Janeiro Univ. (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia). 1980. 6p. (In Portuguese). (CONF-8012116—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703927.

From 4. Brazilian congress on materials science and engineering; Camboriu, Brazil (15 Dec 1980).

The diffusion coefficient of Cu in thin Ni films (350A) at low temperatures is determined by using Auger electron spectroscopy and timepermeation technic. A grain-boundary mechanism is proposed for the diffusion of Cu in Ni. The activation energy is determined to Q=0,6eV. (Author).

6269 (INIS-BR—86, pp 289) **Measurement of Pu-241 in exhaust air, liquid effluents and environmental samples.** Godoy, J.M. de (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)); Schuettelkopf, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A15/MF A01. (CONF-830396—).

From Meeting on radiological protection and dosimetry; Itaipava, Brazil (21 Mar 1983).

6270 (INIS-mf—8536, pp 62) **Application of the positron annihilation technique to the study of colloidal systems.** Reynoso V, R.; Serrano G, J.; Fucugauchi, L.A. (Instituto Nacional de Investigaciones Nucleares, Mexico City). 1982. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6271 (INIS-mf—8536, pp 19) **Fast radiochemical procedure to measure plutonium in environmental samples and in effluents of nuclear installations.** Schuettelkopf, H. (Karlsruhe Nuclear Research Center (Germany, F.R.)). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6272 (INIS-mf—8536, pp 20-21) **Sensitive radiochemical procedure for I-129 in environmental samples and in samples of the Karlsruhe Nuclear Fuel Reprocessing Plant.** Schuettelkopf, H. (Karlsruhe Nuclear Research Center (Germany, F.R.)). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6273 (INIS-mf—8536, pp 22) **Radiochemical procedure for americium and curium in environmental samples and in effluents of nuclear installations.** Schuettelkopf, H. (Karlsruhe Nuclear Research Center (Germany, F.R.)). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6274 (INIS-mf—8536, pp 49) **Simple method for the determination of uranium and thorium by α-spectroscopy and spectrophotometry in environmental samples.** Miekeley, N.; Vale, M.G.; Moreira, L.M. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil)). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6275 (INIS-mf—8536, pp 51-52) **Determination of microelements in soil and plants of the Agricultural Station in Irapuato (Mexico).** Ley Koo, A.M. (Instituto Nacional de Investigaciones Nucleares, Mexico City). 1982. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6276 (INIS-mf—8536, pp 53) **Neutron activation analysis in archaeology-review.** Newton, G.W.A. (Manchester Univ. (UK). Dept. of Chemistry). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6277 (INIS-mf—8536, pp 54) **Black-on-red wade in the levant: a neutron activation analysis study.** Newton, G.W.A. (Manchester Univ. (UK). Dept. of Chemistry). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6278 (INIS-mf—8536, pp 55) **Neutron activation analysis of thermolysis fragments of Cu(II) N,N'-Bis(2-aminoethyl) malondiamide-determination of kinetic parameters.** Mansur, H.N.S.; Mansur Netto, E.; Rodriguez, E.R.; Copray, W.J.A. (Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Quimica). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6279 (INIS-mf—8536, pp 56-57) **Rhenium determination in concentrate MoS_2 of a copper ore.** Moreno B, E.; Campero C, A. (Instituto Nacional de Investigaciones Nucleares, Mexico City). 1982. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6280 (INIS-mf—8536, pp 58-59) **Technique's implementation in water contamination studies.** Velazquez V, M.; Lopez R, C. (Instituto Nacional de Investigaciones Nucleares, Mexico City). 1982. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6281 (INIS-mf—8536, pp 71) **Uranium and thorium determination by epithermal neutron activation analysis.** Bellido, L.F.; Arezzo, B. de C. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6282 (INIS-mf—8536, pp 73) **Mapping and determination of uranium and thorium in rocks by fission track technique.** Medeiros, J.A.; Bouch, C.M. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil)). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6283 (INIS-mf—8536, pp 74) **Determination of uranium and thorium in river water using fission track technique and preconcentration procedures.** Medeiros, J.A.; Cunha, R.P.; Becker, H. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6284 (INIS-mf—8536, pp 27) **Neutron activation analysis of radiolysis fragments of the complex of copper(II) with L-aspargine.** Mansur, H.N.S.; Rodrigues, E.R.; Mansur N, E.; Copray, W.J.A. (Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Quimica). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6285 (INIS-mf—8536, pp 84) **Uranium and other metals in amazon oil shale.** Paschoa, A.S.; Ferro, A.L.; Morales, R.K. (Instituto Militar de Engenharia, Rio de Janeiro (Brazil)); Mafra, O.Y. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).

6286 (INIS-mf—8584, pp 49-54) **Equipment for dekryptonation thermal analysis.** Lukac, P.; Pruzinec, J. (Slovenska Vysoka Skola Technicka, Bratislava (Czechoslovakia). Chemickotechnologicka Fakulta). [nd]. (In Slovak). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Emanation thermal analysis is used for studying changes in the dynamic temperature conditions during kinetics studies of some reactions in solids. A kryptonated sample is placed in a furnace with a programmable temperature controller. ^{85}Kr released from the sample is entrapped by the carrier gas in a through-flow Geiger-Mueller detector. The detector signal is processed into an integral form and recorded. Examples are given of the study of modification transformations in NH_4NO_3, pearlite and PVC. (M.D.).

6287 (INIS-mf—8589) **Study on neutron activation analysis for the determination of the contents of impurities in reactor materials.** Kim, N.B. (Seoul National Univ. (Republic of Korea). Coll. of Engineering). 1983. 81p. (In Korean). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83703929.

In determining the contents of impurity elements in reactor materials using neutron activation analysis, methods for preconcentration and radiochemical separtion have been studied. Before applying neutron irradiation, impurities in uranium dioxide have been preconcentrated by an anion exchange separtion method and boron impurity has been preconcentrated by a cation exchange separation method or an ashing method. After neutron irradiation the radiochemical separation method for the determination of 27 elements is based on a group separation using ion-exchange resin and material exchanger. The method has imployed mineral acid or organic mixture of the acid, excluding hydrofluoric acid, as the media and common glass wares as the apparatus. This separation method was applied to the reactor materials such as aluminum, steel, graphite and uranium dioxide. The single comparator method was used for determining the content of each element separated radiochemically and analytical results gave the statistical and systematic errors of less than 10% and 6.1%, respectively. A prompt gamma-ray measurement method has been used for determining the content of preconcentrated boron and the analytical results gave the statistical and systematic errors of 5.4% and 3.3%, respectively. (Author).

6288 **(LA—9763-M) Manual of analytical methods for radiobioassay.** Gautier, M.A. (comp.). (Los Alamos National Lab., NM (USA)). Jul 1983. Contract W-7405-ENG-36. 163p. NTIS, PC A08/MF A01. Order Number DE84003978.

The manual contains procedures and methods used for the isolation, identification, and quantitative determination of radionuclides in bioasay samples. The methods measure the concentration of the desired analytes with the precision, accuracy, and specificity required by health physics dosimetry. The procedures utilize equipment and skills available in modern radiochemistry laboratories. Precision and accuracy statements derived from quality control studies at the Laboratory are provided. This manual includes radiometric procedures for the analysis of bioassay samples for ^{241}Am, ^{137}Cs, Gross Beta, ^{32}P, ^{210}Po, ^{238} ^{239}Pu, ^{3}T, ^{235} ^{238}U. Colorimetric procedures for Th and U are also included. Each procedure is presented in a simple and concise manner and includes sample collection and storage, interferences, apparatus, reagent preparation, calibration methods, and data reduction formulas.

6289 **(LA—9888-T) Fourier transform and polychromator studies of the inductively coupled plasma.** Faires, L.M.H. (Los Alamos National Lab., NM (USA)). Oct 1983. Contract W-7405-ENG-36. 424p. NTIS, PC A18/MF A01. Order Number DE84003975.

Portions are illegible in microfiche products; Thesis.

Analytical and spectrophysical properties of the inductively coupled argon plasma (ICP) excitation source for analytical atomic spectroscopy have been investigated using both a wavelength dispersive dual-grating polychromator spectrometer and a high resolution Fourier Transform spectrometer. Polychromator studies included documentation of intra-alkali matrix effects and a comparison of top-down and side-on optical design for viewing of the ICP. Fourier Transform studies included the determination of a vertical profile of excitation temperatures in the plasma by the spectroscopic slope method as well as determination of excitation temperatures for several other elements in the normal analytical zone of the plasma, the measurement of line widths of several hundred spectral lines, an assessment of the analytical applicability and advantages of the ICP-FTS, the identification of 500 iron lines and an extension of the ICP into the near infrared spectral region to 1.7μm. Preliminary results are given of an optical design using a fiber optic cable.

6290 **(LA-UR—83-3058) Analytical applications for delayed neutrons.** Eccleston, G.W. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 13p. (CONF-8310104—6). NTIS, PC A02/MF A01. Order Number DE84003776.

From Specialists meeting on yields and decay data of fission product nuclides; Upton, NY, USA (24 Oct 1983).

Analytical formulations that describe the time dependence of neutron populations in nuclear materials contain delayed-neutron dependent terms. These terms are important because the delayed neutrons, even though their yields in fission are small, permit control of the fission chain reaction process. Analytical applications that use delayed neutrons range from simple problems that can be solved with the point reactor kinetics equations to complex problems that can only be solved with large codes that couple fluid calculations with the neutron dynamics. Reactor safety codes, such as SIMMER, model transients of the entire reactor core using coupled space-time neutronics and comprehensive thermal-fluid dynamics. Nondestructive delayed-neutron assay instruments are designed and modeled using a three-dimensional continuous-energy Monte Carlo code. Calculations on high-burnup spent fuels and other materials that contain a mix of uranium and plutonium isotopes require accurate and complete information on the delayed-neutron periods, yields, and energy spectra. A continuing need exists for delayed-neutron parameters for all the fissioning isotopes.

6291 **(LBL—16741) Optical measurement of SO_2 in combustion environments.** Lucas, D.; Brown, N.J. (Lawrence Berkeley Lab., CA (USA)). Oct 1983. Contract AC03-76SF00098. 5p. (CONF-831025—27). NTIS, PC A02/MF A01. Order Number DE84002927.

From 26. ORNL-DOE conference on analytical chemistry in energy technology; Knoxville, TN, USA (11 Oct 1983).

Sulfur dioxide has been measured in a high temperature combustion environment by ultraviolet absorption spectroscopy and by Tunable Atomic Line Molecular Spectroscopy (TALMS). Measurements are made in the post-flame region of a flat flame burner using stoichiometric and lean methane/air mixtures doped with SO_2.

6292 **Some aspects of the geochemistry of gallium in silicate rocks and stony meteorites. Vols. 1-3.** Willis, J.P. Cape Town, South Africa; Cape Town University (1978). vp. Registrar, University of Cape Town, University Private Bag, Rondebosch, 7700.

consists of 3 volumes: text, references and appendices; and tables; and figures.

Frequency distribution diagrams are presented of gallium determinations in oceanic tholeiites and continental dolerites and in the U.S.G.S. standard diabase (dolerite) W-1. Data for the tholeiites and dolerites were determined in this work by a single analytical technique (XRF spectrometry). The data for W-1 have been taken from the literature and were determined by a number of analytical techniques. Disregarding the extreme values reported for W-1, the spread of data for this one rock is still greater than that reported here for sixty-six tholeiites from three different oceans and seventy-four dolerites from four continents in the southern hemisphere. In this work forty-four determinations of gallium in three 4g aliquots of W-1 gave a mean value of 16.5 ppm with a range from 16.1 to 17.1 ppm and a standard deviation of 0.17 ppm (1s).

4002 Inorganic And Physical Chemistry

REFER ALSO TO CITATION(S) 5741, 5789, 5921, 6307

6293 **(DOE/ER/04447—168) Physical-chemical studies of transuranium elements. Progress report, April 1, 1983-March 31, 1984.** Peterson, J.R. (Tennessee Univ., Knoxville (USA). Dept. of Chemistry). 1984. Contract AS05-76ER04447. 48p. NTIS, PC A03/MF A01. Order Number DE84004907.

The report is divided into six sections: spectroscopic and electrochemical studies of Np and Pu in carbonate solutions, delocalization of 5f electrons in Bk and Cf metals under pressure, spectra of lanthanides and actinides in $DMSO_2$, relativistic multiple scattering calculations for metal complexes containing heavy atoms, L x rays in Bk and Cf metals, and solution calorimetry of Bk oxides. (DLC)

6294 (INIS-BR—78, pp 10) **X-ray analysis of metal-(α-amino isobutyric acid) [α-AIBA] complexes. 1. Crystal Structure of Ni (II) (α-AIBA)$_2$.5H$_2$O, Cu (II) (α-AIBA)$_2$ and Zn (II) (α-AIBA)$_2$.nH$_2$O (n=1,2).** Zukerman-Schpector, J.; Oliva, G.; Nascimento, O.R. (Sao Paulo Univ., Sao Carlos (Brazil). Inst. de Fisica e Quimica). 1982. NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

6295 (INIS-BR—78, pp 12) **X-ray analysis of metal-(α-amino isobutyric acid) [α-AIBA] complexes. 2. Structural studies of α-AIBA in Ni (II) (α-AIBA)$_2$.5H$_2$O, Cu (II) (α-AIBA)$_2$ and Zn (α-AIBA)$_2$.n(H$_2$O) (n=1,2).** Zukerman-Schpector, J.; Oliva, G.; Nascimento, O.R. (Sao Paulo Univ., Sao Carlos (Brazil). Inst. de Fisica e Quimica); Calvo, R. (Instituto Venezolano de Investigaciones Cientificas, Caracas). 1982. NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

6296 (INIS-mf—8536, pp 37-38) **Effect of the crystals grinding on the isotopic exchange reaction in the Tl$_2$sup(I)^{204}Tlsup(III)Cl$_6$.** Garcia V, R.; Fernandez V, S. (Instituto Nacional de Investigaciones Nucleares, Mexico City). 1982. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).

Published in summary form only.

6297 (LA-UR—83-3295) **Disproportionation and polymerization of plutonium(IV) in dilute aqueous solutions.** Newton, T.W.; Rundberg, V.L. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 8p. (CONF-831174—29). NTIS, PC A02/MF A01. Order Number DE84003799.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

The rates of polymerization and disproportionation of Pu(IV) have been studied using low concentrations: (1.7 - 10) x 10^{-}M Pu, (0.8 - 12) x 10^{-}M HCl and 0.0iM ionic strength. Osmium(II) complexes such as the tris-4,4'-2,2'-bipyridine complex were found to react rapidly with Pu(IV) but very slowly, if at all, with Pu(IV) polymer, Pu(III), or Pu(V). Thus, it is possible to determine unreacted Pu(IV) in the presence of rection products by using Os(II) complexes. Disproportionation reaction products, Pu(III) and Pu(V), were determined using their reactions with Ce(IV) sulfate. We find $-d[Pu(IV)]/dt = k'[Pu(IV)]^2$ at constant pH. Log k' varies from about 4.25 at pH 3 to about 7.0 at pH 4.1 (units for k' are $M^{-1}min^{-1}$). The $[H^+]$ dependence varies from about -2 to -3 over the pH range studied. The measured rate is the sum of those for polymerization and disproportionation; the latter reaction amounts to about 75% of the total at pH 3 and 20% at pH 4. The second-order rate constants for disproportionation are very much larger than expected on the basis of extrapolation from 0.2 to 1.0M $HClO_4$ solutions. The products of the reaction do not affect the rate, but U(VI), aged Pu(IV) polymer, and CO_2 increase the rate.

6298 **Hydrogen cluster ion equilibria.** Beuhler, R.J.; Ehrenson, S.; Friedman, L. (Department of Chemistry, Brookhaven National Laboratory, Upton, New York 11973). *Journal of Chemical Physics;* 79: No. 12, 5982-5990(15 Dec 1983).

The equilibria $H_3^+ + H_2 = H_5^+$ and $H_5^+ + H_2 = H_7^+$ have been studied using both hydrogen and deuterium in a cooled corona discharge ion source fitted with a very small ion exit aperture. Enthalpies of reaction are in relatively good agreement with results obtained in earlier studies by Hiraoka and Kebarle using a pulse electron impact ion source. Absolute values of equilibrium constants and entropies of reaction are in somewhat poorer agreement. The enthalpy determined for the reaction yielding H_9^+ was found to be in slightly better agreement with the recent theoretical study of Yamaguchi, Gaw, and Schaeffer than results obtained in earlier examinations. A discussion of potential errors in the experimental determination of these equilibria is presented.

6299 **Variational transition state theory calculations for an atom—radical reaction with no saddle point: O+OH.** Rai, S.N.; Truhlar, D.G. (Department of Chemistry, University of Minnesota, Minneapolis, Minnesota 55455). *Journal of Chemical Physics;* 79: No. 12, 6046-6059(15 Dec 1983).

We have extended the general polyatomic canonical variational theory formalism of Isaacson and one of the authors to improved canonical and microcanonical variational theory. We have calculated the rate constants for the reaction in the title over the temperature range 200—2500 K using all three variational theories and the Melius—Blint ab initio potential energy surface. The results are compared to canonical variational calculations based on the reaction-path interpolation scheme of Quack and Troe, to the trajectory calculations of Miller, and to experiment. We find that the microcanonical variational transition states have a strong energy dependence and the generalized free energy of activation curves have two maxima. Quantization effects appear to be important at the lower temperatures, and recrossing effects may be important at higher temperatures.

6300 Application of transition state theory to desorption from solid surfaces: Ammonia on Ni(111). Redondo, A.; Zeiri, Y.; Low, J.J.; Goddard, W.A. III. (Arthur Amos Noyes Laboratory of Chemical Physics, California Institute of Technology, Pasadena, California 91125). *Journal of Chemical Physics;* **79**: No. 12, 6410-6415(15 Dec 1983).

We have used transition state theory to derive analytical expressions for the rates of desorption of atoms and molecules (diatomic as well as polyatomic) from solid surfaces. Realistic forms for the three dimensional adsorbate-surface interaction potentials are employed, including surface corrugation. Using potential parameters from a combination of experiment and ab initio calculations we have applied the rate expressions to evaluate the temperature programmed desorption spectra of NH_3 from Ni(111). Comparing these curves to the experimental spectra leads to a bond energy of $D_0 = 21.0—3.7\Theta$ kcal/mol, where Θ is the fraction of saturation coverage.

6301 Separation of O, C, and S isotopes by two-step, laser photodissociation of OCS. Zittel, P.F.; Darnton, L.A.; Little, D.D. (Chemistry and Physics Laboratory, The Aerospace Corporation, Los Angeles, California 90009). *Journal of Chemical Physics;* **79**: No. 12, 5991-6005(15 Dec 1983).

Isotopes of O, C, and S have been separated by two-step, laser photodissociation of OCS. The technique utilizes isotopically selective vibrational excitation of OCS in the ν_3 (bending) vibrational mode with a line-tuned CO_2 laser ($\lambda \sim 9.4$ μm), followed by photodissociation with a KrF excimer laser ($\lambda = 249$ nm) and chemical scavenging of the sulfur atoms. Enrichment factors ranging from 1.5 to 3.5 were obtained for different isotopes. A sensitive IR absorption apparatus was used to measure absorption of the high energy CO_2 laser pulse by OCS as a function of pressure and laser fluence. Average absorptions ranging up to 1.5 photons/molecule were attributed to rapid rotational relaxation and in part to sequential absorption up the ladder of ν_3 vibrational levels. The 249 nm photodissociation cross section of OCS was measured as a function of absorbed IR energy. An excitation of one CO_2 laser photon per molecule, or two quanta of ν_2 vibration per molecule, increased the photodissociation cross section by a factor of 9 over the thermal (295 K) cross section. A rate constant of $(4.8 +- 1.0) \times 10^5$ s^{-1} $Torr^{-1}$ was inferred for the exchange of ν_2 vibrational energy between isotopic varieties of OCS.

6302 Hydriding system for moderately severe conditions of pressure and temperatures. Elton, J.; Oesterreicher, H. (Department of Chemistry, University of California, San Diego, La Jolla, California 92093). *Review of Scientific Instruments;* **54**: No. 12, 1684-1686(Dec 1983).

A hydriding system capable of pressures up to 1000 atm and temperatures up to 550 °C is described. A pressure generator in which H is outgassed from a metal hydride is used to produce the highest pressures. With this unit one can rather accurately determine the hydrogen uptake in metal hydrides at elevated temperatures and pressures by employing the virial equation of state out to the fourth virial coefficient.

6303 Synthesis, growth and transport properties of the fluorite structured ternary compound K sub(0,4) Bi sub(0,6) F sub(2,2), a superionic conductor. Cassanho, A. Sao Paulo, Brazil; Instituto de Pesquisas Energeticas e Nucleares (1981). 207p. (In Portuguese). Available from IPEN, Sao Paulo, Brazil.

The superionic conductor K sub(0,4) Bi sub(0,6) F sub(2,2) single crystal has been studied. Crystals of this material were synthesised and grown by the zone refining and Bridgman techniques. As in other materials with disordered structure (β-alumina) it was observed that the conductivity depends on the method adopted for the material preparation. It was shown that for the crystal grown from the melt, the conductivity was one order of magnitude higher than the conductivity observed in sintered materials obtained by other authors. The (presumably ionic) electrical conductivity of pure and doped crystals was measured as a function of temperature yielding Arrhenius-like behavior from room temperature to approximatelly 260°C with an activation energy varying between 0,33 to 0,46 ev. Doping the crystals with bivalent and tetravalent cations was found to increase ω for low dopant concentrations whereas O^{-2} doping was found to decrease ω. A phase transition above 300°C not seen before was observed in the conductivity and was confirmed by DTA for the pure crystals. Hysteresis in ω was observed when the crystal is heated over the transition temperature. NMR experiments were used for the first time as a probe of fluorine motion on fluorite structured ternary compounds. Spin-lattice relaxation times measured as a function of temperature revealed interesting features that gave indirect evidence of existing aggregates of point defects contributing positively for the ionic conductivity. (Author).

6304 Studies of the reaction behaviour of the system Y_2O_3-$YFeO_3$-$Y_3Fe_5O_{12}$-Fe_2O_3 and the microwave absorption of $Y_3Fe_5O_{12}$. Wolfmeier, U.H. Hamburg, Germany, F.R.; Hamburg Universitaet (1980). 155p. (In German). Library of Hamburg Univ. (Germany, F.R.).

A study is presented of the chemical reaction mechanism and reaction kinetics of the formation of yttrium-iron garnets and yttrium-ortho-ferrite. Pressed cylindrical sandwiches of all combinations of the binary and ternary oxides are used as diffusion pairs. To determine the layer thickness of the product phases and for quantitative analysis the methods of X-ray diffraction, ESR, DTA as well as optical and electron microscopy have been used. A second reaction mechanism has been studied, which is not controlled by diffusion: the reaction of thermal hydroxide decomposition. Furthermore microwave absorption measurements are presented of spherical ultra-high grade single crystals and nearly amorphous and sintered garnet samples. (orig./HBR).

6305 Selectivity, isotope effect and chiral recognition in olefin metal π coordination. Schurig, V. (Tuebingen Univ. (Germany, F.R.). Inst. fuer Organische Chemie). pp 20 of 2. International symposium on homogeneous catalysis. Abstracts of papers. Frankfurt am Main, Germany, F.R.; Gesellschaft Deutscher Chemiker (1980). (CONF-8009315—Absts.).

From 2. international symposium on homogeneous catalysis and 27. event of FECS; Duesseldorf, F.R. Germany (1 Sep 1980).

4003 Organic Chemistry

REFER ALSO TO CITATION(S) 5670, 5741, 5747, 5755, 5756, 6294, 6295, 6305

6306 (CONF-8305100—8) Reactivity of anthracene in liquid $SbCl_3$-$AlCl_3$-N-(1-butyl)pyridinium chloride mixtures. Zingg, S.P.; Dworkin, A.S.; Sorlie, M.; Chapman, D.M.; Buchanan, A.C. III; Smith, G.P. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 29p. NTIS, PC A03/MF A01. Order Number DE84003275.

From 4. Electrochemical Society international symposium on molten salts; San Francisco, CA, USA (8 May 1983).

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Mixtures of $SbCl_3$ and N-(1-butyl)pyridinium chloride (BPCl) containing 75 to 87 mol % $SbCl_3$ and $SbCl_3$-$AlCl_3$-BPCl mixtures containing 60 mol % $SbCl_3$ and 17 to 24 mol % BPCl were found to be liquid at 25°C. Dilute solutions of anthracene were stable in ternary mixtures containing 18 mol % $AlCl_3$, but in mixtures containing 22 to 24 mol % $AlCl_3$, anthracene reacted under the influence of the solvent, which behaved as both oxidant and H-transfer catalyst. The oxidized product was protonated anthracene, which was stable in this melt. The source of protons was provided by hydrogen-liberating Scholl condensations combined with the reduction of Sb(III). A part of the hydrogen from Scholl reactions reacted with anthracene to form 9,10-dihydroanthracene. By contrast, a liquid mixture without $SbCl_3$, $AlCl_3$-BPCl (2:1 mole ratio), proved to be a much less active H-transfer catalyst than the $SbCl_3$-rich liquids even though it is a stronger Lewis acid, and it did not induce protonation beyond a trace attributable to protic impurities.

6307 **(DOE/PC/60804—T1) Thermophysical properties correlations and pseudocomponent characterization parameter estimation for fossil fluids. First quarterly report, September 1-November 30, 1983.** Starling, K.E.; Lee, L.L.; Ellington, R.T.; Watanasiri, S.; Brule, M.R.; Kumar, K.H.; Khan, M.A.; Langenberg, M.A.; Mannan, M.; Sheth, K. (Oklahoma Univ., Norman (USA). School of Chemical Engineering and Materials Science). 1983. Contract FG22-83PC60804. 29p. NTIS, PC A03/MF A01. Order Number DE84003865.

The objectives of this project are to: (1) develop transport property correlations for nonpolar, polar, and associating coal fluids using the same characterization parameters as those for a multiparameter corresponding-stages thermodynamic correlation for nonpolar, polar, and associating coal fluids. The same characterization parameters are needed to facilitate the next task; (2) develop methods of estimating correlation characterization parameters, such as critical constants, for distillable and nondistillable coal fluids. In the method to be developed, characterization parameters are determined by multiproperty analysis of normal boiling point, specific gravity, viscosity, and other thermophysical properties that can be measured on undefined coal-fluid fractions that have been fractionated by distillation, supercritical distillation (destraction), or other separation and compositional analysis techniques. In order to carry out this method of characterization, the thermodynamic- and transport-property correlations have to be developed using the same characterization parameters; (3) test the characterization method for nondistillable residuum to the extent that measurements of residuum specific gravities, viscosities, and other inspection data are available through the destraction method; and (4) apply the correlations and characterization method to current industry problems in coal liquefaction, such as those encountered at the Wilsonville Advanced Coal Liquefaction (ACL) facility. In the first quarter, pertinent viscosity and thermal conductivity data for pure fluids and mixtures were collected and entered into our data bank. The data collected thus far and the references from which the data were taken are summarized in Appendices. 65 references.

6308 **(INIS-BR—78, pp 11) X-ray structure analysis of amoscanate; an antischistosomal agent.** Zukerman-Schpector, J.; Mascarenhas, Y.P. (Sao Paulo Univ., Sao Carlos (Brazil). Inst. de Fisica e Quimica); Katz, N. (Centro de Pesquisas Rene Rachou, Belo Horizonte (Brazil)). 1982. NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

6309 **(INIS-mf—8227) Infrared spectroscopic studies of the H-D-exchange in the presence of oxide catalysts.** Zachos, A. (Duesseldorf Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 27 Jun 1980. 153p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE83703931.

A liquid sample container has been designed for the infrared spectral region to study the H-D exchange between hydrogen and hydrocarbon compounds and the OH-groups of oxide catalysts by IR-spectroscopy. Several aluminium oxides with γand eta modifications as well as mixed silicon-aluminium-oxides have been characterized spectroscopically. Because of the negativ influence of CO_2 on the H-D-exchange, the adsorption of CO_2 at the catalysts' surface is studied in detail and an interpretation of the adsorption species is given. Furthermore the H-D-exchange kinetics has been studied between benzene as well as benzene-d_6 and the respective OH- and OD-groups of aluminium oxide. Experiments with other hydrocarbon compounds and with hydrogen on deuterated aluminium oxides give the following series of increasing reactivity: cyclohexane, methylcyclopentane, hexane, 3-methylpentane, hydrogen, benzene, hexene-1. (orig./HBR).

6310 **(UCRL—89425) Vapor pressure determination of hydroxy-cyclo-pentyl-butadiyne.** Garza, R.G.; Colmenares, C.A. (Lawrence Livermore National Lab., CA (USA)). 18 Oct 1983. Contract W-7405-ENG-48. 9p. (CONF-8310111—11). NTIS, PC A02/MF A01. Order Number DE84003733.

From 11. DOE annual compatibility meeting; Livermore, CA, USA (18 Oct 1983).

The vapor pressure for the hydrogen getter, Hydroxy-cyclopentyl-Butadiyne (HCPB), was determined thermogravimetrically by the Knudsen technique. Effusion rates were measured in the temperature range of 50 to 100°C.

6311 **Hydrogen-deuterium exchange of macromolecules.** Duane, C.J. London, England; Council for National Academic Awards (1982). 289p. British Library, Boston Spa, Wetherby, West Yorks. No. D44052/82.

Thesis.

An infra red spectroscopic technique has been developed which allows the hydrogen-deuterium exchange between a polymer and absorbed heavy water to be monitored with the polymer in contact with liquid heavy water. This method extends the existing methods to the highest possible internal water concentration. The results of Moore on the hydrogen-deuterium exchange of poly(N-t-butylacrylamide) have been extended to the lower homologues of the series. The rate and extent of the exchange of these polymers is dependent upon the pH of the conditioning solution in which the polymer is exposed prior to the exchange study. The exchange is acid and base catalysed with the latter only apparent in the lower homologues. The features of the acid catalysed exchange have been tentatively explained in terms of the mobility of the hydrogen ion in the polymer matrix, whilst the restricted base exchange is attributed to the lack of hydration stabilisation of the intermediate ion complex of the base catalysed mechanism. The hydrogen-deuterium exchange properties of nylon, silk and cellulose have also been studied and these polymers show far less sensitivity to the pH of the conditioning treatment. The results are discussed.

4004 Electrochemistry

6312 **(LBL—13618) Impedance and ellipsometer measurements of lithium electrodes in propylene carbonate solutions.** Schwager, F.; Muller, R.H. (Lawrence Berkeley Lab., CA (USA)). Sep 1983. Contract AC03-76SF00098. 58p. NTIS, PC A04/MF A01. Order Number DE84003922.

Complex electrode impedance has been measured for lithium after exposure to nitrogen, propylene carbonate and $LiClO_4$ solutions in propylene carbonate. Results for zero-field exchange current density and polarization resistance are in agreement with earlier current pulse measurements. Ellipsometer measurements show a different electrode behavior for anodic and cathodic reactions in perchlorate solution.

6313 **(LBL—16679) Oxygen electrodes for energy conversion and storage. Final report.** Gestaut, L. (Eltech Systems, Inc., Chardon, OH (USA)). Sep 1983. Contract AC03-76SF00098. 392p. NTIS, PC A17/MF A01. Order Number DE84003919.

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The research reported emphasizes the development of more effective electrocatalysts for O_2 reduction and optimization of electrode structures (particularly O_2 cathodes) for utilizing these catalysts. The research approach involved the development of a predictive base through the understanding of the relation of the pathways and kinetics of the electrode reactions to the surface electronic and morphological properties of the electrocatalysts. A specific objective has been the achievement of high performance O_2 cathodes now used in the generation of chlorine and caustic. Over 100 catalyst systems have been examined. Of particular interest are the transition metal macrocyclic complexes and some partially pyrolyzed transition metal macrocycles. High catalytic activity is also obtained with pyrochlores, some spinels and perovskites and some of the carbons. Mechanistic studies have identified pathways relying much on kinetic data obtained with a modification of the rotating ring-disk technique involving the highly dispersed catalyst on a carbon/graphite support in alkaline electrolytes. (LEW)

4005 Photochemistry

REFER ALSO TO CITATION(S) 6331, 6601

6314 **(DOE/ER/10632—5) Studies of the photoelectrochemistry of organic dyes using attenuated total reflection techniques. Annual progress report, June 1, 1983-May 31, 1984.** Spitler, M.T. (Mount Holyoke Coll., South Hadley, MA (USA)). Nov 1983. Contract AC02-80ER10632. 11p. NTIS, PC A02/MF A01. Order Number DE84003718.

Employing two experimenal arrangements of internal reflection spectroscopy, work has been completed which define the energetic threshold for sensitized photocurrent and explore the photochemistry of J aggregate sensitization of semiconductor electrodes by cyanine dyes. The threshold measurements were made using a laser total internal reflection system (laser ATR); the aggregate experiments were done using internal reflection spectroscopy with white light (spectroelectrochemical IRS). A summary is made of the progress in measurements with H-band aggregates of cyanine dyes and triplet state studies with xanthene dyes. The direction of research during the remainder of the contract year is outlined.

6315 **(DOE/ER/10860—T1) Photochemical generation of the optoacoustic effect. Progress report, April 15, 1983-April 14, 1984.** Diebold, G.J. (Brown Univ., Providence, RI (USA). Dept. of Chemistry). Nov 1983. Contract AC02-81ER10860. 14p. NTIS, PC A02/MF A01. Order Number DE84003712.

The aim of research during this period has been to study the properties of the optoacoustic effect produced by the photodissociation and recombination of chlorine. We have observed an acoustic response both from time-delayed recombination of the fragments and from the prompt signal due to photofragment recoil and change in mole number of the gas. The data have been fit to theoretical expressions and have been found to agree well with published rates and bond energies. In addition, calculations have been performed to determine the nature of thermal noise in photoacoustic cells. Finally, a prediction of interference in the fluorescence from molecular photodissociation has been made.

6316 **(DOE/ER/70217—T2) Intermolecular energy transfer processes. Final technical report.** Lee, E.K.C. (California Univ., Irvine (USA). Dept. of Chemistry). 10 Oct 1983. Contract AT03-76ER70217. 29p. NTIS, PC A03/MF A01. Order Number DE84004951.

The following were studied: singlet electronic energy transfer processes, photophysics of single vibrational levels (H_2CO, glyoxal), photophysics of single rotational levels (H_2CO, SO_2), rotation-vibration interaction by Coriolis perturbation, and matrix isolation photochemistry and spectroscopy (H_2CO in O_2 matrix). (DLC)

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 5796, 6284, 6299, 6343, 6344

6317 (INIS-mf—8536, pp 25-26) **Recent progress of radiation-induced polymerization.** Hayashi, K. (Osaka Univ., Suita (Japan). Inst. of Scientific and Industrial Research). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6318 (INIS-mf—8536, pp 28) **Moessbauer studies on the radiation damage produced by the electron-capture in ^{57}Co labelled cobalt(II) carboxylates.** Ladriere, J. (Louvain Univ., Heverlee (Belgium). Lab. de Chimie Nucleaire). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6319 (INIS-mf—8536, pp 29) **Moessbauer studies on the gamma radiolysis of ammonium iron(II) sulfate and its hydrates.** Ladriere, J.; Detaille, B.; Apers, D. (Louvain Univ., Heverlee (Belgium). Lab. de Chimie Nucleaire). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6320 (INIS-mf—8536, pp 30) **Radiolysis of sodium nitrate.** Maddock, A.G. (Cambridge Univ. (UK). Chemical Lab.); Muriel, M. (Universidad Nacional Autonoma de Mexico, Mexico City. Centro de Estudios Nucleares). 1982. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6321 (INIS-mf—8536, pp 31) **Organic products observed in self-radiolyzed $Ba^{14}CO_3$.** Collins, K.E.; Farris, M.G.; Da Costa P, S.; Collins, C.H. (Universidade Estadual de Campinas (Brazil). Inst. de Quimica). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6322 (INIS-mf—8536, pp 32) **Radiolysis of an aqueous solution of malic acid.** Castillo R, B.S.; Negron-Mendoza, A. (Universidad Nacional Autonoma de Mexico, Mexico City. Centro de Estudios Nucleares). 1982. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6323 (INIS-mf—8536, pp 41-42) **Chemical effect of the (n, γ) reaction in the thorium tetrakis (acetylacetonato).** Solache R, M.; Tenorio, D. (Instituto Nacional de Investigaciones Nucleares, Mexico City). 1982. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6324 (INIS-mf—8536, pp 43) **Simulation of ^{38}S-MCl systems.** Todorovsky, D.; Maddock, A.G. (Cambridge Univ. (UK). Chemical Lab.). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6325 (INIS-mf—8536, pp 44-45) **Chemical effects of the ^{99}Mo β^- decay in the ammonium molybdate.** Bulbulian, S. (Instituto Nacional de Investigaciones Nucleares, Mexico City). 1982. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6326 (INIS-mf—8536, pp 33) **Carboxylic acids and carbon monoxide derivatives radiolytically formed in aqueous solutions of nitriles.** Navarro-Gonzalez, R.; Negron-Mendoza, A.; Draganic, Z.; Draganic, I. (Universidad Nacional Autonoma de Mexico, Mexico City. Centro de Estudios Nucleares). 1982. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).

Published in summary form only.

6327 (INIS-mf—8536, pp 34) **Carboxylic acids and carbon monoxide derivatives radiolytically formed in aqueous solutions of cyanides.** Negron-Mendoza, A.; Navarro G, R.; Draganic, Z.; Draganic, I. (Universidad Nacional Autonoma de Mexico, Mexico City. Centro de Estudios Nucleares). 1982. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).

Published in summary form only.

6328 **(PNL-SA—11426) Predicting amounts of radiolytically produced species in brine solutions.** Simonson, S.A.; Kuhn, W.L. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1983. Contract AC06-76RL01830. 9p. (CONF-831174—31). NTIS, PC A02/MF A01. Order Number DE84003346.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

The corrosion of iron overpack materials for nuclear waste forms in salt is highly dependent upon the species produced by the radiolysis of brines which may contact the metal. A computer code has been developed to predict the concentrations of the radiolytically produced species as a function of time using published values for radiation yields of species, chemical reaction rate constants, and parameters derived from experimental evidence.

6329 **Role of homogeneous reactions in the radiolysis of water.** Chatterjee, A.; Magee, J.L.; Dey, S.K. (Univ. of California, Berkeley). *Radiation Research;* **96**: No. 1, 1-19(Oct 1983). Contract AC03-76SF00098.

Chemical effects occur in irradiated systems both in the tracks of particles and in background reactions which take place homogeneously. The latter reactions are considered here in some detail for the case of γ-irradiated water. A model is introduced in which 7 species are involved in 10 reactions to describe irradiated acid water and 11 species are involved in 20 reactions for the case of neutral water. The differential equations of this model are presented. They are ill-conditioned stiff equations and ordinary numerical methods are inadequate to solve them; a method developed by one of us (SKD) has been applied and it is found to yield satisfactory results. This method seems to make possible theoretical studies on irradiated systems involving arbitrary track structure and reaction sequences. Calculations are presented on several cases of γ-irradiated water (acid and neutral). Limited checks with the work of Hochanadel indicate that the model is in satisfactory agreement with experiment if all important species and reactions are used.

6330 **Free radical mechanisms for the oxidation of substituted ascorbates. A pulse radiolysis study of L-ascorbic acid-2-sulfate.** Cabelli, D.E.; Comstock, D.A.; Bielski, B.H.J. (Brookhaven National Lab., Upton, NY). *Radiation Research;* **95**: No. 3, 530-540(Sep 1983).

The oxidations of L-ascorbate 2-sulfate by Br_2^- and OH radicals generated in aqueous solutions (pH 4.5 to 9.5) were studied by pulse radiolysis. The $(2\text{-}SO_4A)\cdot^-$ radical, generated in an electron transfer reaction between Br_2^- and the parent compound, loses sulfate (tau ~ 500 μsec) to give ascorbate free radical ($A\cdot^-$) with a $G(A\cdot^-) = 2.0$. The oxidation of L-ascorbate 2sulfate by OH radicals is complex, yielding both $(2\text{-}SO_4A)^-$ and OH radical adducts. Some of these transients subsequently yield $A\cdot^-$. HPLC studies corroborate the overall mechanism postulated for the oxidation of L-ascorbate 2-sulfate by OH radicals.

6331 **Photochemistry and radiation chemistry of copper(II) complexes in aqueous solutions.** Das, S. Newcastle upon Tyne, England; Newcastle upon Tyne University (1981). 178p. British Library, Boston Spa, Wetherby, West Yorks. No. D37477/81.

Thesis.

Photolysis of Cusup(II) oxalato complexes occurs via an intermediate observed as a transient absorption band (lambdasub(max) = 385 nm) by flash photolysis. This intermediate is identified as a copper-carbon bonded species, $CuCO_2$, by comparison with an apparently identical species formed by reactions of Cusup(I) ions with $\cdot CO_2^-$ radicals in the pulse radiolysis of Cusup(II)-oxalate-formate solutions. The kinetics of this transient have been studied in detail. From the dependence of the first order decay rate constant on pH, Cusup(II) and oxalate ion concentrations and from product yield measurements in steady photolysis, it is proposed that $CuCO_2$ can react via two competing processes: (a) protonolysis giving Cusup(II) and CO and (b) reaction with Cusup(II). Process (b) leads to the formation of Cusup(I) and CO_2 or Cusup(II) and CO depending on oxalate concentration and pH. γ-radiolysis studies on Cusup(II)-oxalate-formate solutions confirmed the results obtained in the photochemical studies.

6332 **Polymer supports for catalysts: The gamma-radiation methods and its consequences.** Hartley, F.R.; Murray, S.G.; Nicholson, P.N. (Royal Military Coll. of Science, Shrivenham (UK). Dept. of Chemistry and Metallurgy). pp 124 of 2. International symposium on homogeneous catalysis. Abstracts of papers. Frankfurt am Main, Germany, F.R.; Gesellschaft Deutscher Chemiker (1980). (CONF-8009315—Absts.).

From 2. international symposium on homogeneous catalysis and 27. event of FECS; Duesseldorf, F.R. Germany (1 Sep 1980).

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 6321, 6642

6333 (INIS-mf—8224) **Spectroscopic studies of uranium(V)-complexes with coordination number eight and six.** Grape, W. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Fakultaet fuer Natur- und Geisteswissenschaften). 30 Jan 1981. 200p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE83703930.

A detailed spectroscopic study is presented of the chemical reaction of uranium-penta ethoxide with acetylacetone in different molar ratios. In this reaction the compound $U(OEt)_4$ acac is produced, where the U(V)-ion is located at a site with nearly octahedric symmetry. The chemical structure of this compound is studied by LF and ESR spectroscopic methods. A new and simple method is presented for the formation of compounds of the type MUF_6. Compounds with M = Li, Na, K, Rb, Cs, NH_4, Ph_4As, Ph_4P and EtN have been produced by exchange halogenation of the respective chloro-complexes with arsenic-trifluoride. These compounds are studied in detail by electron spin resonance, IR spectroscopy and the measurement of f-f-transition spectra. Ligand field theoretical calculations based on Dsub(2d) symmetry are presented for the compounds KUF_6, $RbUF_6$, and NH_4UF_6, in the case of which the U (V)-ion shows an eightfold coordination with a dodecahedric structure. (orig./HBR).

6334 (INIS-mf—8536, pp 14) **Preparation of the CF_3Br gaseous radiotracer.** Rodriguez A, G.; Estrada T, P.; Perez G, V. (Instituto Nacional de Investigaciones Nucleares, Mexico City). 1982. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).

Published in summary form only.

6335 (INIS-mf—8536, pp 16-17) **Preparation of $ScCl_3$ from the irradiated Sc_2O_3.** Cruz de Leon, C.H.; Pantoja G, A.; Lezama C, J. (Instituto Nacional de Investigaciones Nucleares, Mexico City). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).

Published in summary form only.

6336 (INIS-mf—8536, pp 23-24) **Labelled of 3,3',5 triiodothyronine with iodine 125.** Espejel M, B.; Lezama C, J. (Instituto Nacional de Investigaciones Nucleares, Mexico City). 1982. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6337 (INIS-mf—8536, pp 47-48) **Chemical effects of the nuclear reactions Br-81(n, γ)Br-82, Br-79(γ,2n)Br-77, and Os-192(γ,n)Os-191 in K_2OsBr_6-K_2SnCl_6 mixed crystals.** Mueller, H.; Bekk, P. (Freie Univ. Berlin (Germany, F.R.). Inst. fuer Anorganische und Analytische Chemie). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6338 (INIS-mf—8536, pp 69) **Labelled sand with scandium 46 of the specific activities until 0.4 μCi/g.** Gonzalez, G.; Estrada, P.; Herrera, J.M. (Instituto Nacional de Investigaciones Nucleares, Mexico City). 1982. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6339 (INIS-mf—8536, pp 70) **Method for the labelled of sand with scandium 46 for sedimentology.** Estrada, P.; Herrera, J.M.; Gonzalez, G. (Instituto Nacional de Investigaciones Nucleares, Mexico City). 1982. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6340 (INIS-mf—8536, pp 15) **Radiobromine-labelled products from reactor irradiated CBr_4.** Collins, K.E.; Murta, A.L.M.; Bonato, P.S.; Collins, C.H. (Universidade Estadual de Campinas (Brazil). Inst. de Quimica). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6341 (INIS-mf—8536, pp 39-40) **Chemical effects in electron capture stimulated x-ray emission: a study using unlabelled model compounds.** Paci-Mazzilli, B.; Urch, D.S. (Queen Mary Coll., London (UK). Dept. of Chemistry). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6342 (INIS-mf—8536, pp 46) **Some problems concerning the effects of high internally converted isomeric transitions in solids.** Ianovici, E.; Lerch, P. (Ecole Polytechnique Federale, Lausanne (Switzerland)); Maddock, A.G. (Cambridge Univ. (UK). Chemical Lab.). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).
Published in summary form only.

6343 (INIS-mf—8586) **Radioisotopy. Journal contents and index 1959-1970.** (Ustav pro Vyzkum, Vyrobu a Vyuziti Radioisotopu, Prague (Czechoslovakia)). Sep 1982. 125p. (In Czech and English). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83703932.

The contents of the numbers of the journal Radioisotopy are given published in the years 1959 to 1970, the authors index and the subject index, in Czech and in English. (Ha).

6344 (LA-UR—83-3410) **LAMPF nuclear chemistry data acquisition system.** Giesler, G.C. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 10p. (CONF-8310182—11). NTIS, PC A02/MF A01. Order Number DE84003823.

From US fall DECUS symposium; Las Vegas, NV, USA (24 Oct 1983).
Portions are illegible in microfiche products.

The LAMPF Nuclear Chemistry Data Acquisition System (DAS) is designed to provide both real-time control of data acquisition and facilities for data processing for a large variety of users. It consists of a PDP-11/44 connected to a parallel CAMAC branch highway as well as to a large number of peripherals. The various types of radiation counters and spectrometers and their connections to the system will be described. Also discussed will be the various methods of connection considered and their advantages and disadvantages. The operation of the system from the standpoint of both hardware and software will be described as well as plans for the future.

6345 (UCRL—53440) **Critical review of the chemistry and thermodynamics of technetium and some of its inorganic compounds and aqueous species.** Rard, J.A. (Lawrence Livermore National Lab., CA (USA)). 15 Sep 1983. Contract W-7405-ENG-48. 90p. NTIS, PC A05/MF A01. Order Number DE84003909.

Chemical and thermodynamic data for Technetium (Tc) and some of its inorganic compounds and aqueous species are reviewed here. Major emphasis is given to systems with potential geochemical applications, especially the geochemistry of radioactive waste disposal. Compounds considered include oxides, hydroxides, hydrates oxides, halides, oxyhalides, double halides, and sulfides. The aqueous species considered include those in both noncomplexing media (pertechnetates, technetates, aquo-ions, and hydrolyzed cations) and complexing media (halides, sulfates, and phosphates). Thermodynamic values are recommended for specific compounds and aqueous ions when reliable experimental data are available. Where thermodynamic data are inadequate or unavailable, the chemistry is still discussed to provide information about what needs to be measured, and which chemistry needs to be clarified. A major application of these thermodynamic data will be for chemical equilibrium modeling and for construction of potential-pH diagrams for aqueous solutions. Unfortunately, the present lack of data precludes such calculations for complexing aqueous media. The situation is much better for noncomplexing aqueous media, but the chemistry and thermodynamics of cationic Tc(V) species and hydrolyzed Tc(III) species are poorly understood. 240 references, 6 tables.

6346 **Determination of the spectrum of recoil energies for chlorine atoms generated by the $^{35}Cl(n,\gamma)$ ^{36}Cl nuclear process.** Chang, J.; Ferro, L.J.; Spicer, L.D. (Department of Chemistry, University of Utah, Salt Lake City, Utah 84112). *Journal of Chemical Physics;* 79: No. 12, 6419-6421(15 Dec 1983).

The recoil energy spectrum for ^{36}Cl produced in the (n,γ) nuclear reaction is calculated from prompt γ-ray spectroscopy data of Spits and Kopecky. The average energy for the recoil ^{36}Cl atoms is found to be 634 eV, whereas the most probable energy is 720 eV if the maximum recoil energy of 1099 eV is excluded. Comparison is made with the corresponding spectrum for the lower energy, recoil ^{38}Cl atoms also generated by thermal neutron capture.

6347 **Some mechanistic and analytical studies of tritium labelling procedures.** Tang, Y.S. Guildofrd, England; Surrey University (1982). 148p. Available from British Library, Boston Spa, Wetherby, West Yorks. No. D44332/83.

This thesis is concerned with the preparation of tritiated organic compounds by catalytic (both heterogeneous and homogeneous) methods. The radiochemical purity of the product(s) was usually ascertained by using a modified radio-gas-liquid chromatograph, ideally suited for compounds of high specific activity. The tritium distribution within the labelled compound was determined by ^{3}H nmr spectroscopy. The starting point for the investigations was the establishment of a standard tritiation procedure which al-

lowed the use of hydrogen-tritium mixtures, so that the most economic use of tritium gas could be made. The procedure is employed to hydrogenate a number of alkenes. A characteristic feature of the results is the uneven addition of tritium across the double bond. By deliberately under-reducing the substrate it can be shown that a competing exchange reaction is responsible for the above observation. The catalytic dehalogenation of a number of substrates is investigated. A detailed investigation is carried out into the hydrogenation of phenylacetylene. The preparation of N-succinimidyl [2,3-^{3}H] propionate, a tritium labelling reagent for proteins is described, as well as that of its inactive counterpart. The rates of hydrolysis and the optimum conditions for reaction with L-lysine and other substrates are also reported. (author).

6348 **Reaction of recoil tritium atoms with hydrogen and its isotopes.** Ziadeh, Y.Z. Loughborough, England; Loughborough University of Technology (1981). 318p. British Library, Boston Spa, Wetherby, West Yorks. No. D37145/81.

Thesis.

The reaction of recoil tritium atoms is studied with hydrogen and its isotopic variations [T + H_2, T + D_2, T + H_2 - D_2 (1:1 mixture) and T + HD] both theoretically and experimentally. A simple (hard-sphere energy transfer) model of hot atom reactions is modified and used to calculate the reaction cross sections of the various hydrogen isotope systems and the dissociation cross sections of the excited products (HT and DT) in various inert gas moderators (He, Ne, Ar, Kr and Xe). The modified model is also used to calculate the cross sections of hot reactions between recoil tritium atoms and the various scavengers used in this work (O_2, Br_2, ICl). "Wall HT" and the damage caused by the ampoule sealing process are investigated. A comprehensive study of a variety of potential scavengers (O_2, Br_2 and ICl) is made, and the results are analysed in the light of "the corrected kinetic theory for scavenger effects". An efficient scavenger (ICl) has been chosen for use in moderation studies of the hydrogen systems in which helium, argon and krypton are used as moderators. Finally, a simple computer-based mathematical model is described and used in simulating the hot reactions of the hydrogen systems. The theoretical product yields and isotopic effects are compared with their experimental counterparts.

6349 **Spectroscopy of uranyl halide complexes.** Tanner, P. London, England; London University (1980). 426p. Available from British Library, Boston Spa, Wetherby, West Yorks. No. D35830/81.

Polarized luminescence spectra of the $UO_2X_4^{2-}$ ions (X = Cl, Br) have been recorded at temperatures down to 4 K. The spectra are analyzed in terms of: i) a Esub(g) -> Asub(1g)(Dsub(4h)) electronic origin; ii) vibronic origins in at least four of the ungerade internal $UO_2X_4^{2-}$ modes; iii) lattice mode structure; iv) progressions in the νsub(s)(U-X) and rho(OUO) modes on vibronic origins; v) sequences at suitable temperatures; vi) strong progressions in the νsub(s)(OUO) mode on the above features; vii) bands due to isotopically substituted anions. Internal cation and water modes contribute to the vibronic intensity and coupling with internal uranyl modes is detected. Care has been taken to identify bands due to impurities and exciton traps. The luminescence of the $UO_2Cl_4^{2-}$ ion diluted into host lattices is interpreted under Csub(4v) selection rules. New Raman and polarized infrared spectra enable vibrational assignments to be given for the $UO_2X_4^{2-}$ ions. The results are presented and discussed. (author).

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 5760, 6291

6350 **(CONF-8310201—2) Technique for the rapid generation of OH radicals behind shock waves and its application to the study of combustion kinetics.** Szekely, A.; Hanson, R.K.; Bowman, C.T. (Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.). 1983. Contract AT03-76ER70068. 18p. NTIS, PC A02/MF A01. Order Number DE84003183.

From Combustion Institute fall meeting of the western states section; Los Angeles, CA, USA (17 Oct 1983).

A technique for the fast, thermal generation of hydroxyl radicals behind shock waves, useful for the controlled study of elementary reactions involving OH, has been developed. The technique is based on the fact that the room-temperature equilibrium of the reaction NO + NO_2 + H_2O reversible $2HNO_2$ favors the production of HNO_2 (nitrous acid). At the high temperatures present behind shock waves, HNO_2 dissociates rapidly to OH and NO, providing a fast, controllable source of hydroxyl radicals. By measuring the concentration time-history of the OH thus generated in the presence of known amounts of reactants (such as hydrocarbons), the rate coefficient of the generic reaction OH + Re → Products (Re = reactant) can be inferred. For illustrative purposes, the method was applied to the determination of the relatively well-known rate coefficients of two reactions of interest in combustion, OH + OH → O + H_2O and OH + CH_4 → CH_3 + H_2O.

6351 **(DOE/ER/70058—T2) Combustion gas spectroscopy using tunable lasers. Progress report, January 1, 1983-September 30, 1983.** Hanson, R.K. (Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.). 1983. Contract AT03-76ER70058. 9p. NTIS, PC A02/MF A01. Order Number DE84004976.

During this reporting period, work has proceeded in several areas. Highlights include: tunable diode laser measurements of HCN infrared absorption line strengths and lineshapes at room temperature; an advanced absorption lineshape model, including collision narrowing as well as Doppler and collision broadening effects, and its application to high-resolution absorption spectra of HCN; the temperature dependence of collision-broadened linewidths of HCN at high temperatures; and a technique for rapidly tuning a frequency doubled ring dye laser was developed.

6352 **(DOE/ER/70068—T1) Kinetics of some reactions of HCN at high temperatures. Progress report, October 1, 1982-September 30, 1983.** Hanson, R.K.; Bowman, C.T. (Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.). 1983. Contract AT03-76ER70068. 10p. NTIS, PC A02/MF A01. Order Number DE84003512.

The work was divided into two phases: Phase I, now completed, involved studies in shock-heated HCN/Ar and C_2N_2/H_2/Ar mixtures to determine rate coefficients for the thermal decomposition reactions HCN + M → H + CN + M, H_2 + CN → H + HCN, CN + HCN → H + C_2N_2, and C_2N_2 + M → 2CN + M. Phase II entails shock tube studies in various HCN/N_2O/Ar and C_2N_2/H_2O/Ar mixtures to determine rate coefficients for major oxidation reactions including O + HCN → NCO + H, (6) O + HCN → CN + OH, (7) O + HCN → NH + CO, OH + HCN → Products, and OH + HCN → CN + H_2O, with the last reaction to be studied in both the forward and reverse directions. Preliminary results show that reaction (7) plays a substantially greater role, and reaction (6) a lesser role, than previously believed in the O-atom oxidation of HCN.

6353 **(LBL—16790) Collisional energy transfer in the low pressure limit unimolecular dissociation of HO_2.** Brown, N.J.; Miller, J.A. (Lawrence Berkeley Lab., CA (USA); Sandia National Labs., Livermore, CA (USA)). Oct 1983. Contract AC03-76SF00098. 53p. (CONF-8310201—3). NTIS, PC A04/MF A01. Order Number DE84003962.

From Combustion Institute fall meeting of the western states section; Los Angeles, CA, USA (17 Oct 1983).

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Classical trajectory calculations are used to investigate the energy transfer properties of HO_2-He collisions under conditions where HO_2 is initially excited to energies near dissociation. At fixed vibrational energy and heat bath temperature, the magnitude of the average vibrational energy transferred per collision, vertical bar $< \Delta E' >$ vertical bar, increases with increasing molecular angular momentum. At fixed initial molecular angular momentum and heat bath temperature - $< \Delta E' >$ increases as the total energy in the molecule increases, except for very low value of initial angular momentum. Increasing the heat bath temperature for fixed values of the other initial variables decreases the magnitude of $< \Delta E' >$. The relative importance of weak and strong collisions in governing the energy transfer characteristics is discussed. In particular, the probability density function for vibrational energy transfer is not

well represented by a simple exponential down model. A double exponential function is required to represent the long tail of the distribution adequately. Total vibrational energy transfer cross-sections determined from vibrational energy transfer histograms are weak functions of total energy, total angular momentum, and heat bath temperature. They are systematically higher than the corresponding Lennard-Jones cross sections.

42 ENGINEERING

4201 General Engineering

6354 **(AD-A—131252/9) Permanent magnet generator rotor containment study. Final report, September 1980-November 1982.** Siddiqui, E.U.A. (General Electric Co., Binghamton, NY (USA)). May 1983. 148p. NTIS, PC A07/MF A01.

The design, development and testing of an advanced containment structure for high speed permanent magnet machines is presented. The primary intent of the program was to achieve a reduction in system weight, volume and cost through the use of an improved containment design. A secondary objective was to minimize rotor pole face losses and, thus improve generator efficiency.

6355 **(CONF-820614—7) Plastic deformation of a polygon.** Youngdahl, C.K. (Argonne National Lab., IL (USA)). 1982. Contract W-31-109-ENG-38. 32p. NTIS, PC A03/MF A01. Order Number DE84003676.

From 9. US national congress of applied mechanics; Ithaca, NY, USA (21 Jun 1982).

A closed-form solution is derived for the larg plastic deformation of a polygonal frame loaded by a uniform internal pressure. The material of the frame is assumed to be rigid, perfectly-plastic, and the effects of large geometric changes are included. A comparison is made between theoretical results and available experimental data for a pressurized hexagonal tube.

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 5717, 5720, 5721, 5722, 5724, 5942, 6392, 7019, 7036, 7050, 7058

6356 **(BDX—613-2992) Measurement of robot accuracy using the Latin Square Three-Dimensional Ball Plate.** Lembke, J.R.; Jones, L.L. (Bendix Corp., Kansas City, MO (USA)). Nov 1983. Contract AC04-76DP00613. 45p. NTIS, PC A03/MF A01. Order Number DE84004920.

A Latin Square Three-Dimensional Ball Plate (LSBP) was used to characterize the accuracy of a robot. The robot was programmed to partially automate the measurement process. The robot's precision was in the expected range; however, its accuracy was significantly worse than expected.

6357 **(BDX—613-2999) Contamination control.** Jackson, L.C. (Bendix Corp., Kansas City, MO (USA)). Nov 1983. Contract AC04-76DP00613. 6p. NTIS, PC A02/MF A01. Order Number DE84004916.

An evaluation showed that fluoropolymer plastic squeeze bottles can replace polyethylene bottles when used for in-process cleaning. Fluoropolymer plastic squeeze bottles do not contaminate solvents stored in the bottles as polyethylene bottles do. In addition, a limited survey of industrial practices regarding aerosol spray container control showed containers are being controlled without inconveniencing production.

6358 **(LBL—16607) Progress toward 10 tesla accelerator dipoles.** Hassenzahl, W.; Gilbert, G.; Taylor, C.; Meuser, R. (Lawrence Berkeley Lab., CA (USA)). Aug 1983. Contract AC03-76SF00098. 11p. (CONF-830971—8). NTIS, PC A02/MF A01. Order Number DE84002914.

From 8. international conference on magnet technology and exhibition; Grenoble, France (5 Sep 1983).

A 9.1 T central field has been achieved in a Nb-Ti dipole operating in pressurized helium II at 1.8 K. Three different Nb-Ti dipoles, without iron yokes, have achieved central fields of 8.0, 8.6, and 9.1 T - all short sample performance for the conductors at 1.8 K. In helium I, at 4.3 K, the maximum central fields are from 1.5 to 2.0 T lower. Ten-tesla magnets have been designed for both Nb-Ti operating at 1.8 K and Nb_3Sn operating at 4.2 K. They are based on a very small beam aperture, (40 to 45 mm), very high current density in the superconductors (over 1000 A/mm^2), and a very low ratio of stabilizing copper to superconductor (about 1). Both layer and block designs have been developed that utilize Rutherford Cable. Magnet cycling from 0 to 6 T has been carried out for field change rate up to 1 T/s; the cyclic heating at 1 T/s is 36 W per meter. At a more representative rate of 0.2 T/s the heating rate is only 2 W/m. Progress in the program to use Nb_3Sn and NbTi superconductor, in 10 T accelerator magnets is also discussed.

6359 **(NUREG/CR—3536) Simulation of loading conditions for a type A package containing Americium-241 involved in an airplane crash at Detroit Metro Airport in January 1983.** Maxfield, B.W.; Woo, H.H. (Lawrence Livermore National Lab., CA (USA)). Oct 1983. Contract W-7405-ENG-48. 31p. (UCRL—53492). NTIS, PC A03/MF A01 - GPO. Order Number DE84003958.

On January 11, 1983, a United Airlines DC-8F cargo aircraft crashed shortly after takeoff from Detroit Metro Airport. A lower rear cargo pit had a type A package containing 10,000 ^{241}Am solid-form sources, each of 1.5-μCi strength, used in smoke detectors. Although burned and somewhat battered, the 1-gal metal can holding all these sources was recovered completely intact with no release of radioactive material to the environment or loss of any sources. This report describes Lawrence Livermore National Laboratory's attempt to reconstruct, as closely as practical, the mechanical and thermal environments experienced by this can during and immediately after the accident. Mechanical loading of the metal can in a shipping carton was simulated by impacts from a 16-lb pendulum mass falling through vertical displacements of up to 6 ft. Internal damage ranged from imperceptible to sufficient to demolish internal plastic jars and to produce major deformation of the metal can. The thermal environment was best reproduced by the simple burning of the outer shipping carton. 6 references, 27 figures.

6360 **(SAND—83-0432) Development of the parachute recovery system for the LBRV-2 reentry vehicle.** Pepper, W.B. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1983. Contract AC04-76DP00789. 17p. NTIS, PC A02/MF A01. Order Number DE84003340.

A single-stage 6.44-ft-dia ribbon parachute has been developed for deceleration and recovery of a 130-lb nose cone. Recovery procedures begin with jettisoning a part of the initial reentry mass before the parachute is deployed. An operational RV flight resulted in recovery of the payload (in two pieces) and the undamaged parachute.

6361 **(UCID—19850) Assessment methodology for the A-7E: scale model coupling experiments.** Bogdan, E.J.; Wythe, D. (Lawrence Livermore National Lab., CA (USA)). May 1983. Contract W-7405-ENG-48. 445p. NTIS, PC A19/MF A01. Order Number DE84003139.

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Transient electromagnetic measurements were performed on a scale model of the A-7E aircraft as part of the FAANTAEL program concerned with the development of a methodology for assessing navy aircraft. A 1:10 scale model of the A-7E was developed and tested in configurations which resemble those used in the full scale aircraft EMP simulation tests at the Air Force Weapons Laboratory. The scale model reproduced the essential external and internal features including an conductive exterior surface, wings that can be folded, and internal compartments. External coupling measurements included horizontal and vertical polarization with winds up and wings down for different modes such as take-off, on ground, and flight. Internal coupling measurements included currents on model cables such as conduit nose to tail and left avionics bay to horizontal tail. The scale model measurement results were extrapolated to compare with those obtained from the full scale tests. The external measurements compare favorably (factors of two for peak

amplitudes). Internal measurements show greater variation and are consistently higher in peak amplitudes by factors of two to eight.

6362 **Separator assembly for use in spent nuclear fuel shipping cask.** Bucholz, J.A. (to US Dept. of Energy). US Patent 4,399,366. 16 Aug 1983. Filed date 24 Apr 1981. vp. PAT-APPL-257030.

A separator assembly for use in a spent nuclear fuel shipping cask has a honeycomb-type wall structure defining parallel cavities for holding nuclear fuel assemblies. Tubes formed of an effective neutron-absorbing material are embedded in the wall structure around each of the cavities and provide neutron flux traps when filled with water.

6363 **Klassifizierung und Sicherheitsreserven von Transportbehaeltern fuer radioaktive Stoffe. (Classification and safety reserves of radioactive material shipping containers. Final report).** Schulz-Forberg, B.; Huebner, H.W. Berlin, Germany, F.R.; Bundesanstalt fuer Materialpruefung (1979). vp. (In German). Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe (Germany, F.R.).

Taking into account the experimental results and measured data of this study, the applicability of results obtained in the testing of specimens with a scale factor of 1:2 for small-size packagings, and of 1:3 for larger packagings seems to be sufficiently accurately demonstrated so as to be taken as a basis of predicting the behaviour of prototype packagings. This is particularly time for the mechanical forces involved, acceleration and deformation.

4203 Lasers

REFER ALSO TO CITATION(S) 6437, 6449, 6475, 6503, 6553, 6571, 6783

6364 **(INIS-mf—8365) Annual report 1982 Beschleunigerlaboratorium of Univ. and Technische Univ. Muenchen.** (Beschleunigerlaboratorium der Univ. und Technischen Univ. Muenchen, Garching (Germany, F.R.)). [nd]. 165p. (In German). Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe (Germany, F.R.).

6365 **(UCRL—89215) Radially resolved simulation of a high-gain free electron laser amplifier.** Fawley, W.M.; Prosnitz, D.; Doss, S.; Gelinas, R. (Lawrence Livermore National Lab., CA (USA); Science Applications, Inc., Pleasanton, CA (USA)). 27 Jun 1983. Contract W-7405-ENG-48. 18p. (CONF-8306121—5). NTIS, PC A02/MF A01. Order Number DE84003751.

From 4. workshop on free-electron laser devices; Eastsound, WA, USA (27 Jun 1983).

The results of a two-dimensional simulation of a high-gain free electron laser (FEL) amplifier is presented. The simulation solves the inhomogeneous paraxial wave equation. The source term is radially resolved and is obtained by tracking the interaction of the laser field with localized macroparticles.

6366 **(UCRL—89439) Insulator materials in high power lasers for inertial fusion: present and future.** Krupke, W.F. (Lawrence Livermore National Lab., CA (USA)). 11 Nov 1983. Contract W-7405-ENG-48. 24p. (CONF-831174—28). NTIS, PC A02/MF A01. Order Number DE84003738.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

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A summary is given of the important characteristics of currently used insulator materials. Figures of merit for materials needed in future systems are identified. A methodology for identifying and evaluating new materials meeting the stringent performance requirements of future fusion laser systems is outlined.

6367 **Generation of tunable cw radiation near 875 nm.** Gilberson, K.W.; Jeys, T.H.; Dunning, F.B. (Rice University, Physics Department, Houston, Texas 77251). *Applied Optics;* 22: No. 18, 2768-2769(15 Sep 1983).

In an attempt to obtain more efficient pumping of the color-center laser, we undertook a detailed comparative study of the performance characteristics of Styryl 9 and HITC using a Spectra-Physics model 375 dye laser equipped with HITC optics and a high pressure (120-psi) dye circulator. (AIP)

6368 **Injection locking of excimer lasers.** Bigio, I.J.; Slatkine, M. (Los Alamos National Lab., NM). pp 155-157 of Lasers '81. Collins, C.B. McLean, VA; STS Press (1982). (CONF-811229—).

From International conference on lasers; New Orleans, LA, USA (14 Dec 1981).

The channeling of the energy of high-power excimer lasers into very narrow spectral bandwidths in low divergence beams is a prerequisite for many potential applications of these lasers. High spectral brightness is required for spectroscopic applications and optical harmonic generation, and the long coherence length associated with a narrow bandwidth is required for nonlinear phase conjugation, and backward stimulated Brillouin and Raman scattering among other applications. The simplest way to control the spectral bandwidth and beam divergence of high-gain excimer lasers involves the combined implementation of an unstable resonator and injection locking. The present investigation is concerned with the criteria which determine reliable injection locking of unstable resonator excimer lasers (or other high-gain lasers) with minimal injected power. It is found that the implementation of relatively simple techniques can allow the experimenter with a modest budget and level of effort, to obtain an ultraviolet excimer source of very high quality.

6369 **Suprathermal electron pumping of X-ray lasers.** Carman, R.L. (Los Alamos National Lab., NM); Chapline, G.F. pp 173-176 of Lasers '81. Collins, C.B. McLean, VA; STS Press (1982). (CONF-811229—). Contract W-7405-ENG-48;W-7405-ENG-36.

From International conference on lasers; New Orleans, LA, USA (14 Dec 1981).

Very high flux densities of suprathermal electrons with energies up to several hundred keV, can be produced by focusing high power laser beams to small spots on solid surfaces. If these suprathermal electrons can be confined in a sufficiently small volume, they can produce significant 3p to 3s and 4 to 3 population inversions in highly stripped medium Z ions.

6370 **High pressure experiments on Al/sub x/Ga/sub 1-x/As-GaAs quantum-well heterostructure lasers.** Kirchoefer, S.W. (Univ. of Illinois, Urbana); Holonyak, N. Jr.; Hess, K.; Gulino, D.A.; Drickamer, H.G.; Coleman, J.J.; Dapkus, P.D. *Solid State Communications;* 42: No. 9, 633-636(1982). Contract AC02-76ER01198.

Hydrostatic pressure experiments on Al/sub x/Ga/sub 1-x/As-GaAs quantum-well heterostructure (QWH) laser diodes are described. Data are presented giving ~ 11.5 MeV/kbar for the bandgap vs pressure coefficient at lower pressures, with a change to 8.5-9 MeV/kbar at higher pressures. We suggest that this behavior is caused by biaxial and shear stresses in the active region induced by doping or composition mismatch relative to the confining layers, or between the n and p confining layers themselves. A model consistent with the experimental data is presented.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 5687, 6804

6371 **(AD-A—131788/2) Reactive-heat-pipe for combined heat generation and transport. Interim technical report.** You, H.Z.; Faeth, G.M. (Pennsylvania State Univ., University Park (USA). Dept. of Mechanical Engineering). Dec 1977. 110p. NTIS, PC A06/MF A01.

A reactive-heat-pipe concept is described which involves the reaction between lithium and sulfur-hexafluoride. For this concept, the lithium is evaporated from the inner surface of the wick and reacts with gaseous sulfur-hexafluoride; the energy of reaction is conducted through the wick causing lithium to evaporate from the outer surface of the wick, the vapor then transfers the energy of reaction by condensing on the heat exchanger surfaces of the load. A small combustor, generating 7.5 kW, operating at condenser tem-

peratures of 1200 K, was designed and tested to demonstrate the operation of the concept. The system was also analyzed in order to examine the design characteristics of the wick, the vapor transport system and the condensation process on the load. The results indicate an optimum mesh size for the wick, and suggest that arterial wicks are desirable for some operating conditions. The greatest thermal resistance found in the study results from the presence of noncondensibles in the system; and several methods of control are suggested to minimize this difficulty.

6372 **(DOE/ET/13146—T14) Turbulent combustion experiments and modeling. Final report, August 1, 1978-December 31, 1982.** Lapp, M.; Drake, M.C.; Penney, C.M.; Pitz, R.W.; Correa, S. (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Center). Sep 1983. Contract AC04-78ET13146. 262p. NTIS, PC A12/MF A01. Order Number DE84002806.

This report summarizes the first detailed program on NO/sub x/ formation from thermal and fuel-bound-nitrogen sources in a turbulent diffusion flame based upon detailed thermodynamic and flow field data integrated with a fundamental modeling approach. The major advances reported lie in (1) the development of advanced pulsed laser diagnostic techniques; (2) detailed quantitative characterizations of a well-defined turbulent combustor configuration; (3) the generation of flame modeling procedures that include realistic descriptions of turbulent mixing fluctuations and chemical kinetic mechanisms and rates; and (4) a better understanding of fluid mixing-chemistry interactions, molecular diffusivity, and other turbulent diffusion flame processes. The thermodynamic and flow field variables were measured with vibrational Raman scattering and laser velocimetry, with sampling techniques used for NO/sub x/ determination. Detailed comparisons with the modeling (k-ϵ turbulence closure, assumed pdf, equilibrium chemistry) produced good agreement, including results within roughly a factor of 2 for thermal and FBN-produced NO.

6373 **(DOE/NASA—0131-2) Numerical modeling of turbulent flow in a channel.** Dai, Y.W.; Ghoniem, A.F.; Sherman, F.S.; Oppenheim, A.K. (California Univ., Berkeley (USA)). Mar 1983. Contract W-7405-ENG-48. 68p. (NASA-CR—168278). NTIS, PC A04/MF A01. Order Number DE84004834.

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Two-dimensional incompressible turbulent flow in a channel with a backward-facing step was studied numerically by Chorin's Random Vortex Method (RVM), an algorithm capable of tracing the action of elementary turbulent eddies and their cumulative effects without imposing any restrictions upon their motions. The step occurs in one side of a channel with otherwise flat, parallel walls; its height equals 1/3, 1/4, or 1/5 the width of the channel downstream. The main objective was to investigate the behavior of the large-scale turbulent eddies in a flow and the flow characteristics in the separated shear layer, the reattached zone, and the rebuilding boundary layer after reattachment. The unsteady vorticity field and the distribution of time-averaged turbulent statistics were obtained. The effects of expansion step height and initial boundary layer state were also studied. Comparisons were made with the available experimental results. The agreement is satisfactory in the velocity profiles and in the reattachment length, and fairly good in the turbulence profiles. Also, a mechanism of the development of the reattaching turbulent flow was suggested by the numerical results.

6374 **(LA-UR—83-3205) Acquisition systems for heat transfer measurement.** De Witt, R.J. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 32p. (CONF-830852—2). NTIS, PC A03/MF A01. Order Number DE84003779.

From Measurement techniques in power engineering summer school; Dubrovnik, Yugoslavia (29 Aug 1983).

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Practical heat transfer data acquisition systems are normally characterized by the need for high-resolution, low-drift, low-speed recording devices. Analog devices such as strip chart or circular recorders and FM analog magnetic tape have excellent resolution and work well when data will be presented in temperature versus time format only and need not be processed further. Digital systems are more complex and require an understanding of the following components: digitizing devices, interface bus types, processor requirements, and software design. This paper discusses all the above components of analog and digital data acquisition, as they are used in current practice. Additional information on thermocouple system analysis will aid the user in developing accurate heat transfer measuring systems.

6375 **(PB—83-247577) Plate heat exchangers: review of transport phenomena and design procedures.** Focke, W.W. (Council for Scientific and Industrial Research, Pretoria (South Africa)). Feb 1983. 53p. (CSIR-CENG—445). NTIS, PC E04/MF E01.

The Chilton-Colburn analogy for momentum and heat transfer is not valid for plate heat exchangers. However, for the turbulent regime a correlation exists between heat transfer and energy dissipation. Turbulence models based on an energy dissipation analogy may, therefore, provide a good basis for predicting the flow and heat transfer in plate heat exchangers. Flow distribution to plates is a critical aspect of plate heat exchanger performance, particularly where cooling of highly viscous and non-Newtonian fluids are involved and give rise to laminar flow. For this flow regime very little information is available. Design flexibility is obtained by using chevron plates of different corrugation angles in one exchanger. The existence of optimal angles has been identified.

6376 **(SAND—83-1366C) Evaluation of inviscid/boundary layer and parabolized Navier-Stokes solutions for design of reentry vehicles.** McWherter, M.; Noack, R.W.; Oberkampf, W.L. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 16p. (CONF-840133—2). NTIS, PC A02/MF A01. Order Number DE84003254.

From 11. aerospace sciences meeting; Reno, NV, USA (9 Jan 1984).

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Numerical predictions made by a traditional inviscid/boundary layer method and a parabolized Navier-Stokes method are compared with wind tunnel data for slender, blunted, cones at moderate angle of attack. Mach numbers ranged from 6 to 14 and Reynolds numbers from 0.4 to 16 million. The purpose of the comparison is to evaluate the mach number and Reynolds number range of applicability of the two prediction methods. Also described are the practical aspects of using these two methods in a design environment.

6377 **(SAND—83-1392C) Finite element analysis of incompressible turbulent backstep flow with heat transfer.** Polansky, G.F.; Lamb, J.P.; Crawford, M.E. (Sandia National Labs., Albuquerque, NM (USA); Texas Univ., Austin (USA)). 1983. Contract AC04-76DP00789. 25p. (CONF-840133—1). NTIS, PC A02/MF A01. Order Number DE84003101.

From 11. aerospace sciences meeting; Reno, NV, USA (9 Jan 1984).

The finite element method is investigated as a means of simulating incompressible turbulent flow with heat transfer. The governing equations include the complete, two-dimensional Navier-Stokes equations expressed in terms of primitive variables. The turbulent viscosity is determined by a two-equation (k-ϵ) model of turbulence. Both high Reynolds number and low Reynolds number forms of the two-equation model are considered. The formulation is first tested in a fully developed channel flow developed channel flow geometry. Although the high Reynolds number turbulence model is found to be incompatible with the current numerical scheme, good results are obtained using the low Reynolds number model. The formulation is then applied successfully to flow past a confined backward facing step. The results of the current calculations are compared with experimental data and a variety of other computational results.

6378 **Laminar natural convection in an inclined rectangular box with the lower surface half-heated and half-insulated.** Chao, P.K.; Ozoe, H.; Churchill, S.W.; Lior, N. (Graduate School, Department of Chemical Engineering, University of Pennsylvania, Philadelphia, PA 19104). *Journal of Heat Transfer;* **105**: No. 3, 425-453(Aug 1983). Contract AC04-78CS35365.

The pattern of circulation and the rate of heat transfer were determined experimentally and also by three-dimensional, finite-difference calculations for an inclined 2 x 1 x 1 rectangular enclosure with a 1 x 1 segment of the lower 2 x 1 surface at a uniform temperature, the other 1 x 1 segment and four side walls insulated, and the upper surface at a lower uniform temperature. As contrasted with an enclosure heated and cooled on the horizonal surfaces, a fluid motion occurs and the rate of heat transfer exceeds that for pure conduction for all temperature differences and orientations. The effects of elevation of the heated and insulted segments were investigated, as well as of inclination about the longer dimension. Despite differences in the Prandtl and Rayleigh numbers, the observed and predicted patterns of circulation are in good agreement, and the measured and predicted rates of heat are in qualitative agreement.

6379 **Measurement of fusion boundary energy transport during Arc welding.** Landram, C.S. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Journal of Heat Transfer;* **105**: No. 3, 550-570(Aug 1983). Contract W-7405-ENG-48.

An experimental technique is presented to identify fusion boundary (liquid/solid interface) energy transport mechanisms during welding procedures. The gas-tungsten-arc-spot-welding procedure, using a low melting (point specimen material (lead), was chosen to demonstrate the methods. Vaporization energy losses were found to be important during the growth of the fusion boundary. Significant thermal convection was absent within the weld pool for applied currents less than about 1000 A, and for such cases the location of the fusion boundary was found to be governed primarily by heat conduction. At the current levels of almost 300 A significant weld pool convection was found to exist, expecially at the (inner) stagnation point, causing a deeper penetration of the fusion boundary there.

6380 **Surface microfouling during the induction period.** Baier, R.E.; Meyer, A.E.; DePalma, V.A.; King, R.W.; Fornalik, M.S. (Advanced Technology Center, Calspan Corporation, Buffalo, New York 14225). *Journal of Heat Transfer;* **105**: No. 3, 618-624(Aug 1983). Contract AC02-80ER10766.

The time during which newly installed or cleaned heat transfer surfaces remain free of fouling deposits thick enough to dimenish heat transfer coefficints or energy efficiency is often called the "induction period." a term disgusing lak of knowledge of the microfouling events actually occurring. Using novel flow cells to conduct water of fresh, brackish, and oceanic quality, natural and treated with antifouling chemicals, over test surfaces of different clean and coated metals, it has been observed that the initial pattern of fouling deposits is remarkably similar in all circumstances. Rapid adsorption of protein-dominated films is followed by attachment of rodlike bacteria, bacterial exudation, colonization by a second wave of prosthecate microorganisms, additional secretion, and growth of debris-trapping filamentous appendages. Although inappropriate to extrapolate the noted rates of these processes to in-plant heat exchangers at present, this sequence of mircofouling events seem universal enough to characterize the induction period of all water-side biofouling phenomena.

4205 Materials Testing

REFER ALSO TO CITATION(S) 5933, 6964

6381 **(MLM—3098) Eddy current thickness gauge for reel-to-reel tape processes.** Harvey, E.D.; Dudley, W.A. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 27 Oct 1983. Contract AC04-76DP00053. 25p. NTIS, PC A02/MF A01. Order Number DE84004050.

An eddy current device has been designed and built to provide non-contact thickness gauging of copper and aluminum films vapor-deposited onto Kapton tape. This thickness gauge, using a 6800 series CPU (central processing unit) to process eddy current information supplied by a phase-sensitive eddy current instrument, provides a precision of +- 1 μin. The accuracy is limited to that of the standards used.

4207 Vacuum Engineering

6382 **(CONF-831063—11) Vacuum sorption pumping studies of nitrogen on molecular sieves.** Perona, J.J.; Crabb, K.S.; Byers, C.H.; Watson, J.S. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA)). 1983. Contract W-7405-ENG-26. 20p. NTIS, PC A02/MF A01. Order Number DE84003295.

From American Institute of Chemical Engineers fall annual meeting; Washington, DC, USA (30 Oct 1983).

Both current experiments and future applications of fusion energy require clean roughing pumps to evacuate chambers with volumes of up to 10^7 L. Large cryosorption pumps, in which gases are sorbed on deep beds of molecular sieves at liquid nitrogen temperature, are under consideration for this service; however, little is understood of the heat and mass transport processes that occur as the gas is sorbed. This understanding is necessary to ensure the success of further scale-up. A simple mass transfer model was developed, with the assumption of constant equilibrium loading, which permitted an analytical solution of the transport equations. Comparison of this model with experimental data on the nitrogen-4A system allowed estimates of the hydrodynamic transport parameter to be made.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 6252

6383 **(BDX—613-2905) General-purpose data acquisition system for component testing. Final report.** Jump, R.D. (Bendix Corp., Kansas City, MO (USA)). Nov 1983. Contract AC04-76DP00613. 102p. NTIS, PC A06/MF A01. Order Number DE84004928.

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A general-purpose data acquisition system was developed by using the Commodore CBM 8032 microcomputer and IEEE-488 bus-compatible instrumentation. A general data file structure was established for all types of electrical components, and software drivers were written for the basic test instruments. Modular data acquisition and data reduction programs were written to test thermistors and resistors. A current-carrying scanner was designed to permit computer control of the power applied to the components and to permit switching of the instrumentation from sample to sample.

6384 **(DOE/TIC/EG—82/139) Digital circuit analyzer: logic board tester makes a powerful diagnostic tool in design, production, and maintenance.** (USDOE Technical Information Center, Oak Ridge, TN). [nd]. 106p. NTIS, PC A06/MF A01. Order Number DE84004601.

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A portable digital circuit analyzer features 120 independently-programable input/output (I/O) channels for testing large, complex integrated-circuit (IC) boards. It has 15-MHz speed (data change rate) and 1024-bit storage capacity per channel. The instrument also doubles as a basic 120-channel time-domain analyzer, providing triggering on any data pattern with up to 4095 steps of post-trigger recording within the storage capacity of 1024 memory locations. As a board tester, the instrument detects and displays logic errors, including slow-logic and timing problems. The boards are tested by comparing their signature with that of a good logic board used as a reference. Errors in the board under test are revealed by the alternate flashing of both the good signature and the test signature on the same set of display lights. Each channel of the analyzer may be independently or jointly edited, and during logic testing, it may independently assume any of its three primary functions: (1) transmitter (OUTPUT), (2) receiver (INPUT), and (3) recorder (by

default when neither OUTPUT nor INPUT). Programing is uncomplicated, and programs may be modified during board testing - a necessary feature in troubleshooting unfamiliar boards. Such modifications include the addition or deletion of entire I/O channels, and data-string generation of any predetermined length of 1's, 0's, or random patterns. This is in addition to single-bit changes. It is possible to load automatically square waves of varying periods, ranging from a change at every memory location to a change after each 64 memory locations, each period being twice as long as the preceding one.

6385 **(PB—83-255216) Brush and brushless excitation of a synchronous generator using a thyristor-magnetic amplifier regulator. Research report.** El Sersawi, A.; Shepherd, W. (Bradford Univ. (UK). Postgraduate School of Electrical and Electronic Engineering). Sep 1980. 32p. NTIS, PC E04/MF E04.

A new method was developed for the regulation and excitation of an experimental 25kVA generator, using a combination of a thyristor bridge and a magnetic amplifier. The separately excited field of the exciter machine was controlled by a full wave single-phase or 3-phase bridge circuit with the exciter armature current controlled by a single pulse magnetic amplifier. The system was operated in linear or non-linear modes, associated with steady state and dynamic operation respectively, and compared with a simulated power system with corresponding performance obtained using a Goldington regulator. A good correlation was obtained between conventional Goldington operation and linear operation for steady state conditions. Nonlinear operation using the new regulator gave better results for transient performance. The system was satisfactory for supporting the thermal voltage and increasing the transient stability of a generator. Maximum improvement of transient stability was obtained when the bridge delay angle was between 60 degrees and 80 degrees for load switching angles in the region of 30 degrees to 45 degrees.

6386 **(PB—83-255224) Performance of synchronous generator with thyristor controlled load. Research report.** El Sersawi, A.A.; Shepherd, W.; Barnett, S. (Bradford Univ. (UK). Postgraduate School of Electrical and Electronic Engineering). Mar 1981. 15p. NTIS, PC E03/MF E03.

A method was developed for improving the power factor and the stability of a power system, and also of reducing current harmonics, by combining the thyristorised shunt reactor in parallel. The system investigated had a regulated inverse-parallel thyristorised load and a regulating inverse-parallel thyristorised shunt reactor, both star-connected, with their neutral points joined. Control of the load voltage was obtained by the symmetrical phase-angle triggering of the pairs of load thyristors in each angle triggering of the pairs of shunt thyristors. Compensation was achieved by operating the shunt thyristor block with a delay angle of 180 degrees minus the load thyristor delay angle. A thyristor state-space transition matrix was derived by sampling and hold techniques. Optimum response was obtained by the experimental 25 KVA system when the per-unit reactance of the compensator equalled the per-unit reactance of the load.

6387 **(SAND—83-1668C) Evaporative cooling: a new approach to thermal management in liquid impregnated plastic film capacitors.** Mauldin, G.H.; Thompson, M.C. (Sandia National Labs., Albuquerque, NM (USA); Los Alamos National Lab., NM (USA)). 1983. Contract AC04-76DP00789. 5p. (CONF-8303110—1). NTIS, PC A02/MF A01. Order Number DE84003762.

From 4. capacitor and resistor technology symposium; Orlando, FL, USA (6 Mar 1983).

On this joint program, a unique approach to thermal management has been discovered. By using low boiling temperature perfluorocarbons as the liquid impregnant, an evaporative cooling cycle can be initiated that prevents internal hot spots from running away. This feature allows the capacitors to operate at higher field stresses without failure. Thus far it appears that at least an order of magnitude increase in energy density in repetitive discharge service can be achieved with this technique. This paper will describe the design approach to accomplish this as well as present electrical and thermal data proving that it is effective.

4210 Combustion Systems

REFER ALSO TO CITATION(S) 6126, 6127, 6570

6388 **(CONF-821176—4) Direct combustion of solid carbonaceous fuels: the diffusionally controlled regime.** Daw, C.S.; Krishnan, R.P. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 18p. NTIS, PC A02/MF A01. Order Number DE84003280.

From International conference on combustion of tomorrow's fuels; Santa Barbara, CA, USA (8 Nov 1982).

This is a review of the current understanding of diffusionally controlled combustion. Emphasis is placed on identifying those parameters which determine the relative importance of external diffusion and how this relates to the particle burning rate. Conceptual models which have been proposed for these relationships are discussed. Among the parameters considered are temperature, pressure, intrinsic reactivity, particle size, gas properties, and flow conditions. Most solids combustion data in the literature are for graphite, coal char, and petroleum coke. A brief review is given of experimental data which demonstrate the relative importance of external diffusion for these fuels. Primary emphasis is given to fluidized bed combustion, since it will probably be the method of choice for burning many low-grade fuels. Finally, specific experimental and theoretical needs for future work are identified.

6389 **(DOE/PC/30215—9) Freeboard reactions in fluidized coal combustion. Technical progress report, February 1, 1983-April 30, 1983.** Walsh, P.M.; Mayo, J.E.; Beer, J.M. (Massachusetts Inst. of Tech., Cambridge (USA)). 31 May 1983. Contract FG22-80PC30215. 34p. NTIS, PC A03/MF A01. Order Number DE84003701.

The fluxes of descending large particles and agglomerates were measured at heights from 0.7 to 1.9 m above a bed of particles having solid density and mean size similar to those present in AFBC. The particle flux decreased approximately exponentially with height in this region. The characteristic lengths for decay of the descending particle flux were similar in magnitude to those reported previously for the decay of ascending particle flux above beds of smaller particles of various materials. The dependence of this characteristic length on superficial velocity has not usually been well-established in studies of ascending particle flux over limited ranges of superficial velocity. The characteristic lengths determined in the present investigation were approximately proportional to superficial velocity. Extrapolation of the particle flux profiles to the bed surface yielded values which were factors of 10 to 100 lower than most of the previous determinations of initial entrainment above beds of smaller particles. Variation of the extrapolated flux from one experiment to another may be due not only to differences in obstructions, tube diameters, and particle properties, but to differences in the heights above the bed at which the measurements are made. If different particle ejection mechanisms give rise to different velocity distributions, these will be reflected in the heights which the particles ejected by a given mechanism will reach. This may cause the dependence of flux on height to be too complex for reliable extrapolation from relatively large distances to the bed surface.

6390 **(DOE/R6/12021—T1) Catalytic combustion: an investigation of combustor geometry effects. Shelton Energy Research report No. 8272R.** Shelton, J.; Graeser, L. (Shelton Energy Research, Santa Fe, NM (USA)). Jan 1982. Contract FG46-80R612021. 85p. NTIS, PC A05/MF A01. Order Number DE84003119.

A Riteway Model 37 wood stove was modified to accept a catalytic combustor. Twenty-six metal plates coated with a platinum/palladium catalyst were assembled into one, two or three layers (26, 13 and 9 plates per layer). The stove's energy efficiency was measured without the catalyst and with the catalyst in each of its three geometries. A combination of room calorimetry and flue gas heat loss measurements was used for these determinations. The one-layer catalyst increased the unit's combustion efficiency by 11 percentage points to 95 percent at a power output of 35,000 Btu/h. Increases of 8 and 5 percentage points were recorded for the two- and three-layer geometries, respectively. In order to investigate rel-

ative creosote plugging rates in the event of catalyst failure or low temperature operation, two samples of each substrate geometry were installed in the flues of six identical stoves and cool fires were burned for four days. Total creosote accumulation was greatest for the sparser geometries, but it was less hazardous - the pressure drop for a given flow was less because of the wider spacing. Total plugging is a definite possibility in relatively short time periods for all geometries. Two passive bypass systems were investigated to detour flue gases around a total obstruction of the catalyst. One of these recirculated flue gas during normal stove operation, but both alleviated the possible safety hazard of smoke spillage. Finally, a theory of catalyst design was developed and tested; it predicted the experimental combustion efficiencies within two percentage points.

6391 **(PB—83-245837) Evaluation of combustion modification effects on emissions and efficiency of wood-fired industrial boilers. Final report, April-October 1979.** Tidona, R.J.; Carter, W.A.; Buening, H.J.; Cherry, S.S. (KVB, Inc., Irvine, CA (USA)). Aug 1983. 92p. NTIS, PC A05/MF A01.

The report gives results of full-scale tests to evaluate combustion modifications (lower excess air and variations in the overfire air system operation) for emission control and efficiency enhancement on two wood-fired industrial boilers. Polycyclic organic matter (POM) was sampled at both baseline and optimum low-NOx conditions. Under baseline conditions, POM emissions were similar to those of a coal-fired spreader stoker and an oil-fired boiler, but were well below those of a pulverized-coal-fired boiler tested previously. For the wood-fired boiler, POM emissions in the low-NOx mode were higher than those at baseline.

6392 **Positive displacement vacuum-sweep dispenser for small particles.** Sherman, P.M.; Glass, D.R.; Postman, D. (Department of Aerospace Engineering, The University of Michigan, Ann Arbor, Michigan 48109). *Review of Scientific Instruments;* **54**: No. 12, 1705-1707(Dec 1983). Contract FG22-80PC30305.

A dispenser was developed for feeding small particles into a laboratory burner at a very constant flow rate. A positive displacement of a continuously replaced volume of particles is employed combined with a sonic ejector. The combination meets the requirements for good chemical measurements. The system also satisfies the requirements for laser-Doppler anemometry.

4220 Underground Engineering

REFER ALSO TO CITATION(S) 5719

4250 Power Cycles

6393 **(DOE/FE—0027) Advanced coal systems.** (USDOE Assistant Secretary for Fossil Energy, Washington, DC). Jun 1983. 11p. NTIS, PC A02/MF A01. Order Number DE84003986.

Advanced technologies for efficiently producing energy from coal are briefly described, including: heat engines, such as coal-fired gas turbines and diesel engines; hot gas cleanup; coal fuel cells; and coal-fired magnetohydrodynamics. (LEW)

43 PARTICLE ACCELERATORS

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 6414, 6449, 6515, 6546, 6927

6394 (DOE/ER/40058—1, pp 494-501) **MAX: a cw electron beam accelerator system.** Eriksson, M. (Univ. of Lund, Sweden). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

The main goal for the MAX electron accelerator system is to produce a continuous electron beam up to 100 MeV and synchrotron light at a electron energy of 550 MeV. The accelerator system consists of a 100 MeV injector racetrack microtron and a 550 MeV pulse-stretcher/storage ring.

6395 (DOE/ER/40058—1, pp 505-507) **Conceptual design for a 2 GeV CW electron microtron.** Kustom, R. (Argonne National Lab., IL). 1983. NTIS, PC A99/MF A01. (CONF-820475—). Contract W-31-109-ENG-38.

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

In this paper we describe the conceptual design of a 2 GeV CW electron microtron developed at Argonne as part of the national effort to establish the technology for continuous beam electron accelerators above 1 GeV. The basic accelerator design incorporates a CW double-sided microtron [Ka 79]. The maximum design energy of the accelerator is 2.05 GeV. Variable-energy extraction from 0.5 to 2.05 GeV is approximately 25 MeV steps of the three beams with individually controlled energies is part of the design. An energy spread of 10^{-4} in each beam is the design objective. The design objective for beam current is 100 μamps per extracted beam with the option of independent current control from near zero to 100 μa for each of the three extracted beams. A current stability of 1 to 5% will be necessary to make maximum use of the 100% duty factor. The design value for the extracted beam radius in 0.4 mm and for beam divergence is +- 0.5 mr. The maximum beam emmittance is 0.2 π mm-mr. The accelerator has been designed to accelerate transversely polarized electrons without depolarization.

6396 (DOE/ER/40058—1, pp 508-510) **150 MeV pulse stretcher at Sendai.** Tamae, T. (Tohoku Univ., Sendai, Japan). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

High duty cycle beams are inevitable for new electron accelerators due to the rapid development of nuclear physics. After considering several types of accelerators to deliver continuous beams, a conventional-type 1.2 GeV linac together with a pulse stretcher has been chosen at Sendai because of its existing technology and adaptabilities for various research. A 150 MeV pulse stretcher, a test ring for the proposed plan, has been completed at the end of the last year, and is now under test operation. The ring stores a pulsed beam whose energy range is from 100 MeV to 150 MeV and produces a continuous beam. It increases the duty cycle up to 90%. A pulsed beam is bent from the present linac beam line to the ring by two bending magnets (M9,M10). An extracted continuous beam returns to the initial direction towards the electron spectrometer. The circumference of the ring is 15.47 m. In the case of a two turn injection, a pulsed beam of 100 nsec is injected from the linac with the repetition rate of 300 pps and the peak current of 100 mA. The intensity of an extracted continuous beam is expected to be around 3 μA.

6397 (DOE/ER/40058—1, pp 511-536) **Four GeV electron accelerator laboratory.** York, R.C.; McCarthy, J.S.; Norum, B.E. (Univ. of Virginia, Charlottesville). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

A design for a 4 GeV, high current, high duty factor electron accelerator facility is presented. This design is based upon the use of a high intensity, low duty factor linac injecting into a pulse stretcher ring at energy. The required high duty factor current is extracted from the ring. The total cost of this facility including the accelerator, experimental areas and equipment, support buildings, and necessary contingencies has been estimated at 87 million 1982 dollars.

6398 **(LBL—16639) Power-amplification of a heavy-ion beam in an induction linac.** Faltens, A.; Keefe, D. (Lawrence Berkeley Lab., CA (USA)). Sep 1983. Contract AC03-76SF00098. 7p. (CONF-830911—36). NTIS, PC A02/MF A01. Order Number DE84002911.

From 5. international conference on high power particle beams; San Francisco, CA, USA (12 Sep 1983).

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In contrast to an rf linac - a constant-current device in which the beam power is increased solely by the addition of kinetic energy, qV, - the induction linac (I.L.) can amplify the beam power at a much more rapid rate. Proper programming of the switching of the modules and the shape of their voltage waveforms, in the early stages of acceleration, can result in a beam current that rises at a rate between V/sup 1/2/ and V and, consequently, a beam power that varies in the range V/sup 3/2/ to V^2. The current is limited by the transport lens system, which must overcome the beam defocusing force due to space charge.

6399 **(SLAC-PUB—3214) Fifty megawatt klystron for the Stanford Linear Collider.** Lee, T.G.; Lebacqz, J.V.; Konrad, G.T. (Stanford Linear Accelerator Center, CA (USA)). Sep 1983. Contract AC03-76SF00515. 4p. (CONF-831243—3). NTIS, PC A02/MF A01. Order Number DE84003516.

From International electron device meeting; Washington, DC, USA (5 Dec 1983).

The proposed Stanford Linear Collider (SLC) has been designed to provide 50 on 50 GeV electron-positron collisions. The performance of the 240 klystrons driving the two-mile long linac must be upgraded to achieve at least 50 Megawatts of peak power output at a pulse of 5 μsec and a pulse repetition frequency of 180 pulses per second. The operating frequency of the upgraded linac will continue to be 2856 MHz. A klystron amplifier meeting these new requirements has been designed to operate at 315 kV, $\mu k = 2$, with a computed efficiency of slightly greater than 50%. Initial tests indicate the achievement of the basic power objectives; however, observed parasitic instabilities make beam focusing, RF drive frequency and drive level extremely critical. High electric fields in the electron gun, output gap and output window are all potential problems. Steps taken in the design to overcome these problems are discussed and test results are presented.

6400 **(SLAC-PUB—3227) High pulse power rf sources for linear colliders.** Wilson, P.B. (Stanford Linear Accelerator Center, CA (USA)). Sep 1983. Contract AC03-76SF00515. 6p. (CONF-830822—44). NTIS, PC A02/MF A01. Order Number DE84003517.

From 12. international conference on high energy accelerators; Batavia, IL, USA (11 Aug 1983).

RF sources with high peak power output and relatively short pulse lengths will be required for future high gradient e^+e^- linear colliders. The required peak power and pulse length depend on the operating frequency, energy gradient and geometry of the collider linac structure. The frequency and gradient are in turn constrained by various parameters which depend on the beam-beam collision dynamics, and on the total ac wall-plug power that has been committed to the linac rf system. Various rf sources which might meet these requirements are reviewed. Existing source types (e.g., klystrons, gyrotrons) and sources which show future promise based on experimental prototypes are first considered. Finally, several proposals for high peak power rf sources based on unconventional concepts are discussed. These are an FEL source (two beam accelerator), rf energy storage cavities with switching, and a photocathode device which produces an rf current by direct emission modulation of the cathode.

6401 **Heavy ion collisions in a collider at BNL.** Barton, M.Q. (Brookhaven Nat.'l Lab., Upton, NY 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2020-2021(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Heavy ions accelerated in the AGS can be injected into a CBA and provide colliding beams up to 400 Q/A GeV/amu. Luminosities approaching values as high as $10^{28}/cm^2sec$ should be achievable even though the ions must be accelerated through a phase transition. More current might be stacked by using a special jump method to avoid the excessive radial aperture usage at transition. It is possible to construct a CBA for heavy ions less expensively than for protons because the energy required for the physics is not as high. If one constructed a CBA with a lattice similar to the usual proton design but with only a third of the dipole magnets in place, resulting in what is called a missing magnet lattice, the resulting energy of 133 Q/A GeV/amu would be adequate for the physics problems which could currently be addressed. Presumably the full complement of dipole magnets would be added later for the usual program with protons. This paper discusses the similarities and differences between regular lattice and missing magnet lattice CBA performance and investigates the other implications involved in the theory, design, construction and cost of a CBA at Brookhaven.

6402 **An equivalent circuit model of the general 3-dimensional RFQ.** Hutcheon, R.M. (Atomic Energy of Canada Limited, Research Company, Chalk River Nuclear Laboratories, Chalk River, Ontario KOJ 1JO). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3524-3526(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

An equivalent circuit model has been developed, based on the description of the RFQ as a terminated waveguide. The RFQ is modeled as a length of inductively loaded square waveguide operating in "TE_{10}" and "TE_{11}" like" modes in the dipole and quadrupole configurations respectively. This is described by 6 coupled first order differential equations using distributed values for the four quadrant shunt admittances and series impedances. The end terminations are represented by lumped terminating reactances. The first few orders of both dipole and quadrupole modes are described by the model. By relating the equivalent circuit values to physical dimensions, the effects on frequency and field distributions of vane movement, tube distortion, individual end tuner movement and vane strapping were determined. Agreement with measured properties is reasonable, and some new insights on RFQ operation have been gained.

6403 **The Fermilab RFQ project.** Neuffer, D.; Curtis, C.D.; Huson, F.R.; Kerns, Q.A.; Martinez, A.; Owen, C.W.; Schmidt, C.W.; Treadwell, E.; Villa, G.J. (Fermi Nat.'l Accelerator Lab., P.O. Box 500, Batavia, IL 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3527-3529(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A 200 MHz Radio Frequency Quadrupole (RFQ) Linac is being designed and constructed for the acceleration of H^- ions from 30 keV to 750 keV at a current of 30 mA. The RFQ is being developed as a possible replacement for the Fermilab preaccelerator and as an R and D project to investigate RFQ properties for future accelerators. The current status of the project is described.

6404 **A spiral-resonator radio-frequency quadrupole accelerator structure.** Stokes, R.H.; Humphry, F.J.; Potter, J.M.; Roybal, P.L. (Los Alamos Nat.'l Lab., Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3530-3532(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A radio-frequency quadrupole (RFQ) structure operating at low frequency has been developed for possible use in accelerators for heavy ion fusion or Tokamak plasma heating. The structure uses a series of shunt spiral inductors placed periodically along the electrodes of an electric quadrupole to achieve resonance at the desired frequency. A 1.2-m-long model has been constructed for low-power testing. The model resonates near 12 MHz and has radial dimensions that are reduced by a factor of 15 compared to the commonly used four-vane resonator.

6405 **Beam dynamics and vane geometry in the LBL heavy ion RFQ.** Staples, J. (Lawrence Berkeley Lab., Univ. of Cal., Berkeley, CA 94720). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3533-3535(Aug 1983). (CONF-830311—). Contract AC03-76SF00098.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The LBL Heavy Ion RFQ accelerator, presently undergoing acceptance tests, extends the application of the RFQ principle to charge-to-mass ratios considerably less than one. In this design the aperture is very small compared to the operating wavelength, causing a large capacitive loading of the structure and also in a high sensitivity of the field configuration of the structure to vane alignment. A structure has been derived that eases the vane alignment procedure and reduces the sensitivity to vane misalignment. The selection of the vane cross section facilitates machining and eventual frequency trimming.

6406 **100% duty factor RFQ linac systems at CRNL.** Hutcheon, R.M.; Brown, J.C.; Hansborough, L.D.; Schriber, S.O.; Turner, R.B. (Atomic Energy of Canada Ltd., Research Co., Chalk River Nuclear Lab.'s, Chalk River, Ontario KOJ 1JO). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3557-3559(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

An RFQ linac operating at 100% duty factor (cw) and high currents is required for an accelerator breeder. Two high power structures are being built as part of the RFQ development program. Firstly, a copper 270 MHz "sparker" cavity with RFQ geometry is being tested to determine cw field breakdown levels and conditioning characteristics. The design and status of the "sparker" are presented. Secondly, a 270 MHz cw RFQ linac (RFQ1) is being designed to accelerate a nominal 75 mA from 50 to 600 keV, to study beam quality and stability as well as resonator field tuning and leveling requirements under conditions of high beam loss at high average power. For example, the combination of cw operation and restricted space at the entrance require new approaches in end terminations and tuners. The status of RFQ1 is presented and design innovations outlined.

6407 **Development of an RFQ linac at KEK.** Kato, T.; Fukumoto, S.; Igarashi, Z.; Kubota, C.; Takasaki, E.; Takenaka, T. (KEK, Nat.'l Lab. for High Energy Physics, Oho-machi, Tsuka-gun, Ibaraki-ken 305). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3569-3571(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

An RFQ model linac of 62 cm long at a frequency of 200 MHz was constructed using a computer program "QKEK" developed at KEK. QKEK generates an RFQ linac, calculates beam dynamics, and provides geometrical data of vanes for a numerically controlled milling machine. A detailed study of rf characteristics was performed. The accelerating and focusing fields measured by the bead perturbation method on axis agree well with the design values. An RFQ linac, which accelerates protons from 50 keV to 750 keV, is designed.

4302 Beam Dynamics, Field Calculations, And Ion Optics

REFER ALSO TO CITATION(S) 6396, 6483, 6490, 6491, 6550

6408 **(BNL—51706) Non-linear variation of the beta function with momentum.** Parzen, G. (Brookhaven National Lab., Upton, NY (USA)). Jul 1983. Contract AC02-76CH00016. 18p. NTIS, PC A02/MF A01. Order Number DE84003878.

A theory is presented for computing the non-linear dependence of the β-functions on momentum. Results are found for the quadratic term. The results of the theory are compared with computed results. A procedure is proposed for computing the strengths of the sextupole correctors to correct the dependence of the β-function on momentum.

6409 **(CAPE—2912) SLAC SPEAR one-inch toroidal current transformer (beam lines 16/17) (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). 9 Dec 1983. Contract AC03-76SF00515. TIC, PO Bx 62, Oak Ridge, TN 37831.

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The drawings on the drawing list provide the data and specifications for constructing a one-inch toroidal beam current transformer. This device is a toroidal coil consisting of a few or more turns of conductor which then produces a voltage proportional to the current in the beam. The voltage pulse (pulsed beams) can be shaped, stored, etc., and then used when properly calibrated to read the current in the beam. This device was used in the SPEAR injection beam lines No. 16 and 17 in the beam switchyard at SLAC.

6410 **(CONF-820980—8) Beam front accelerators.** Reiser, M. (Maryland Univ., College Park (USA)). 1982. Contract AS05-78ER05940. 19p. NTIS, PC A02/MF A01. Order Number DE84003709.

From European Committee of future accelerators - the challenge of ultra-high energies conference; Oxford, UK (27 Sep 1982).

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An intense relativistic electron beam cannot propagate in a metal drift tube when the current exceeds the space charge limit. Very high charge density and electric field gradients (10^2 to 10^3 MV/m) develop at the beam front and the electrons are reflected. When a neutral gas or a plasma is present, collective acceleration of positive ions occur, and the resulting charge neutralization enables the beam to propagate. Experimental results, theoretical understanding, and schemes to achieve high ion energies by external control of the beam front velocity will be reviewed.

6411 **(CONF-830311—193) Proposed second harmonic acceleration system for the intense pulsed neutron source rapid cycling synchrotron.** Norem, J.; Brandeberry, F.; Rauchas, A. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01. Order Number DE84003601.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

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The Rapid Cycling Synchrotron (RCS) of the Intense Pulsed Neutron Source (IPNS) operating at Argonne National Laboratory is presently producing intensities of 2 to 2.5 x 10^{12} protons per pulse (ppp) with the addition of a new ion source. This intensity is close to the space charge limit of the machine, estimated at ~3 x 10^{12} ppp, depending somewhat on the available aperture. With the present good performance in mind, accelerator improvements are being directed at: (1) increasing beam intensities for neutron science; (2) lowering acceleration losses to minimize activation; and (3) gaining better control of the beam so that losses can be made to occur when and where they can be most easily controlled. On the basis of preliminary measurements, we are now proposing a third cavity for the RF systems which would provide control of the longitudinal bunch shape during the cycle which would permit raising the effective space charge limit of the accelerator and reducing losses.

6412 **(DOE/ER/02408—218) System for producing high-resolution polarized and unpolarized beams with a tandem accelerator.** Westerfeldt, C.R.; Bilpuch, E.G.; Bleck, M.E.; Outlaw, D.A.; Wells, W.K.; Wilkerson, J.F.; Clegg, T.B. (Duke Univ., Durham, NC (USA); Triangle Universities Nuclear Lab., Durham, NC (USA); North Carolina Univ., Chapel Hill (USA)). 1983. Contract AS05-76ER02408. 37p. (ORO—2408-218). NTIS, PC A03/MF A01. Order Number DE84004054.

A tandem accelerator beam energy stabilizer, which utilizes an optically coupled fast feedback loop to the accelerator terminal stripper, is described. Emphasis is placed on the components of the feedback system and on the application of this system to production of high energy-resolution beams. This system produces beam energy spreads ranging from 450 to 600 eV FWHM for 2 to 16 MeV unpolarized protons. Polarized beam energy spreads range from 550 to 700 eV FWHM, for the same beam energy range.

6413 **(DOE/ER/40003—2) Dissipative effects in the beam-beam interaction of intersecting storage rings. Progress report.** (Georgia Inst. of Tech., Atlanta (USA)). 1983. Contract AS05-81ER40003. 3p. NTIS, PC A02/MF A01. Order Number DE84004871.

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In our most recent research, we have begun a systematic analysis of the effects of dissipation in the beam-beam interaction. Specifically, we consider the case of cylindrically symmetric beams for which a global invariant of the motion exists. This fact allows one to reduce the dimensionality of the system by two, and the original problem is converted into the study of a map of the plane into itself.

6414 **(LA—9898-MS) Reference design for LAMPF II.** Thiessen, H.A. (Los Alamos National Lab., NM (USA)). Oct 1983. Contract W-7405-ENG-36. 51p. NTIS, PC A04/MF A01. Order Number DE84003972.

A reference design for the 32-GeV LAMPF II proton accelerator is proposed. This design consists of a 30-Hz rapid-cycling synchrotron with a dc stretcher. A superperiodicity 5 design with dispersion-free straight sections is suggested for both machines. Beam-dynamics calculations are partially complete and rf requirements are given. Apertures are calculated for 2 x 10^{13} protons per pulse (100-μA average current). No significant problems are observed at any time in the cycle in a longitudinal beam-dynamics simulation including space charge.

6415 **(LBL—16034) 20 TeV collider lattices with low-β insertions.** Garren, A.A. (Lawrence Berkeley Lab., CA (USA)). Aug 1983. Contract AC03-76SF00098. 8p. (CONF-830822—43). NTIS, PC A02/MF A01. Order Number DE84003051.

From 12. international conference on high energy accelerators; Batavia, IL, USA (11 Aug 1983).

A lattice containing insertions designed for collisions of 20 TeV proton beams at crossing points having beta values of two meters or less is presented. The machine would use high-field double bore superconducting magnets, with opposite focusing action on the two beams passing through each quadrupole. Hence the focusing pattern in the insertions is antisymmetric about the crossings. The beams, separated by 16 cms in the arcs are made colinear by dipoles common to both beams and then focused to the low-β collision points by quadrupole triplets. A similar machine design for pp collisions is also included.

6416 **(SLAC/AP—8) Stability of the coherent quadrupole oscillations excited by the beam-beam interaction.** Kamiya, Y.; Chao, A.W. (Stanford Linear Accelerator Center, CA (USA)). Oct 1983. Contract AC03-76SF00515. 22p. NTIS, PC A02/MF A01. Order Number DE84003901.

We study the coherent quadrupole motion in the presence of beam-beam interaction, using a linear approximation to the beam-beam force. The corresponding beam-beam limit is determined by evaluating the eigenvalues of a system of linear equations describing the coherent quadrupole motion. We find that the stability of the quadrupole motions imposes severe limits on the beam current, as is the case for the dipole instability. Preliminary results of this study have appeared elsewhere.

6417 **(SLAC-PUB—3229) Calculation of polarization effects.** Chao, A.W. (Stanford Linear Accelerator Center, CA (USA)). Sep 1983. Contract AC03-76SF00515. 16p. (CONF-8309144—7). NTIS, PC A02/MF A01. Order Number DE84003520.

From EPS conference on computing in accelerator design and operation; Berlin, F.R. Germany (20 Sep 1983).

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Basically there are two areas of accelerator applications that involve beam polarization. One is the acceleration of a polarized beam (most likely a proton beam) in a synchrotron. Another concerns polarized beams in an electron storage ring. In both areas, numerical techniques have been very useful.

6418 **(UCRL—88922) Electron beam propagation in the ion focused regime (IFR) with the experimental test accelerator (ETA).** Struve, K.W.; Lauer, E.J.; Chambers, F.W. (Lawrence Livermore National Lab., CA (USA)). 28 Sep 1983. Contract W-7405-ENG-48. 7p. (CONF-830911—37). NTIS, PC A02/MF A01. Order Number DE84003895.

From 5. international conference on high power particle beams; San Francisco, CA, USA (12 Sep 1983).

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The IFR is a well-known stable, low pressure (0.10 to 0.120 torr in air) propagation window. Secondary electrons created by collisions of beam electrons with gas atoms are rapidly expelled by the strong radial electric field of the beam charge. The ions that remain inside the beam partially neutralize the electric field, allowing magnetic pinch forces to focus the beam. Experiments with the ETA beam have re-verified this stable window and are reported. Image forces from a close wall IFR propagation tank are also experimentally shown to center the beam and damp transverse oscillations. Results of experiments using 5 and 15 cm dia beam tubes are reported. For p tau $>$ 2 torr-nsec (gas pressure x time into pulse the beam charge becomes completely neutralized by the ions, allowing a build up of plasma and resultant beam-plasma instabilities. The onset of these instabilities has been measured using rf pickup loops (0 to 2 GHz) and microwave detectors (6 to 40 GHz), and are also reported.

6419 **General theory of magnetically insulated electron flow.** Mendel, C.W. Jr.; Seidel, D.B.; Slutz, S.A. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physics of Fluids;* **26**: No. 12, 3628-3635(Dec 1983). Contract AC04-76DP00789.

A theory of magnetically insulated flow is developed where two- or three-dimensional spatial variation and temporal variation are allowed as long as the spatial variations in the flow direction are over many electron gyrolengths and temporal variations are over many electron gyroperiods. These criteria are met in most flows of interest. The theory is based upon describing the electron dynamics in terms of parameters which are constants of motion in one-dimensional, time-independent flows.

6420 **A nonlinear lens system to smooth the intensity distribution of a Gaussian beam.** Meads, P.F. Jr. (7053 Shirley Dr., Oakland, CA 94611). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2838-2840(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The intensity distribution of a typical ion beam is quite nonuniform with a bright center and a diffuse edge; in many cases, the actual distribution is adequately approximated by a Gaussian distribution. However, many uses for such beams require uniform illumination from the center of the target to its edges. It is shown here that a system of controlled third-order aberrations produced by a pair of octupole magnets is able to sustantially smooth the intensity distribution by spreading the center and folding in the edges of the beam such that the intensity is nearly uniform over the entire target.

6421 **Discrete precision beam switching in linear induction accelerators through harmonics control.** Denno, K. (N.J. Inst. of Technology, Newark, NJ 07102). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2915-2917(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Continued development in inertial fusion reactor research identifies the potential of providing beam of heavy ions associated with long pulse duration, low level of kinetic energy and multi-kiloamperes current. This paper presents continuation of work for the ultimate goal of precision design in the spark gap switching mechanism for the linear induction accelerators including the core type as well as the line type. The pulse switching involves the utilization of the saturable - resistor with hard ferromagnetic material core, where sudden changes in its ohmic value can provide precise automatic switching synchronized with that of the charging beam. Cal-

culations centered on establishing remarkable switching sequence spectrum with respect to the fundamental frequency as well as for a discrete sequence of harmonics contained in the saturableresistor exciting current. Discrete time switchings are characterized in the form of discrete pulses with continuous ascending sharp increase in amplitude and controlled reduction in time duration.

6422 **The resistive longitudinal instability threshold in finite charged beams.** Sternlieb, A. (Soreq Nuclear Research Center, Yavneh 70600). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2573-2575(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Heavy ion beams are considered as possible drivers in an inertial confinement fusion scheme. The high required intensities introduce space - charge effects. It has been shown analytically that a finite cold beam is longitudinally stable when a small resistive term is present. This is confirmed by simulations which show that for resistivities causing less than one e-folding of a perturbation over the bunch length, the beam is stable (unlike coasting beam), probably due to end reflections. However, for resistivities causing more than three e-foldings, the beam is unstable (emittance deteriorated exponentially). The authors discuss the implication of this instability threshold for a full-scale driver model, a multiplebeam driver, single beam transport experiment-SBTE (LBL), and a slow e-beam experiment (Maryland).

6423 **Emittance calculations for the Stanford linear collider injector.** Sheppard, J.C.; Blocker, C.A.; Clendenin, J.E.; Helm, R.H.; Lee, M.J.; Miller, R.H. (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA 94305). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2161-2163(Aug 1983). (CONF-830311—). Contract AC03-76SF00515.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A series of measurements has been performed to determine the emittance of the high intensity, single bunch beam that is to be injected into the Stanford Linear Collider. Online computer programs were used to control the Linac for the purpose of data acquisition and to fit the data to a model in order to deduce the beam emittance. This paper describes the method of emittance calculation and presents some of the measurement results.

6424 **A measurement of the transverse particle distribution in the presence of the beam-beam interaction.** Decker, G.; Talman, R. (Lab. of Nuclear Studies, Cornell Univ., Ithaca, New York 14853). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2188-2189(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The beam beam interaction in e^+ e^- storage rings causes significant beam size enhancement limiting the attainable luminosity. It is important to understand this effect, in particular the resulting particle distribution shape. Measurements at CESR have been made using an active probe to obtain horizontal beam profiles and detailed information regarding the vertical distribution tail shape. An estimate of the effect of the probe on the beam is given and results are presented.

6425 **Beam steering at the Stanford Synchrotron Radiation Laboratory.** Hettel, R.O. (Stanford Synchrotron Radiation Lab. (SSRL), SLAC Bin 69, Box 4349, Stanford, CA 94305). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2228-2230(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Instability of the vertical synchrotron beam position in the experimental lines at SSRL has motivated the continuing development of its steering control system. Recent improvements have increased its ability to compensate for long term position drift and to suppress low frequency beam oscillation induced by ground motion. A description of the new system and an analysis of its performance is presented.

6426 **Measurement of the instantaneous 200-MHz bunch currents at 750 keV for the CERN Linac 2.** Knott, J. (CERN, Geneva). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2244-2246(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The efficiency of the longitudinal matching of the low energy proton beam with a double drift harmonic buncher (DDHB) depends on the correct setting of RF levels of the first and second harmonic buncher cavities and their respective phase. The adjustment is done by means of a retractable destructive broadband probe situated in front of the Linac input. It is essentially a piece of a well matched 50 Ω line intercepting the beam perpendicular to its axis. At the beam side it is an asymmetric double strip line, forming a 1 mm gap between a highly transparent grid (90%) and a tantalum insert stopping the incoming beam on the inner conductor. One side of the line is open ended, the other smoothly tapered over a length of 30 mm into a coaxial line, continued outside the vacuum with a flexible low loss cable to observe the bunch signal on a 1.2 GHz real time oscilloscope. This signal should give the longitudinal proton density distribution and permits to optimize the bunching efficiency and to adjust the phase between the two buncher cavities to about 1° at 200 MHz. For high intensity beams the interpretation of the bunch shape requires some precaution as secondary and thermal electrons modify considerably the form of the expected signals.

6427 **The space charge computer program SCHAR.** Hayden, R.J.; Jakobson, M.J. (Dept. of Physics and Astronomy, Univ. of Montana, Missoula, Montana 59812). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2540-2542(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The space charge computer program SCHAR uses macrofilaments or macroparticles to model the effects of space charge in ion transport. The program calculates the transport properties of beams of non-relativistic charged particles using two alternative macroparticle formulations. The line mode formulation considers the beam to be composed of a manageable number of infinitely long charged filaments. The paths of these filaments are fixed in time but their positions as a function of distance along the line are determined by a fourth-order Runge-Kutta time step integration. The point mode formulation considers the beam to be composed of a manageable number of charged macroparticles. These macroparticles have the same charge-to-mass ratio as the actual particles. In this mode the space charge effects are modeled solely by the Coulomb repulsion of the macroparticles. In space charge cases, while the calculation steps from SCHAR are identical, the line mode will run by a factor of two or three times faster than the point mode; if beam bunching occurs, however, use of the line mode becomes inappropriate. Both modes are described by SCHAR in a left-handed Cartesian coordinate system. Among the optional methods for spreading out the filaments or particles in phase space are: four-volume distribution, designed for line mode operation; KV distribution, a specialized four-dimensional input assumed also by TRACE; six-volume distribution, meant for point mode but also applicable to line mode operation; and "observed" distribution, designed for point mode operation.

6428 **Beam breakup (BBU) instability experiments on the experimental test accelerator (ETA) and predictions for the advanced test accelerator (ATA).** Caporaso, G.J.; Cole, A.G.; Struve, K.W. (Lawrence Livermore Nat.'l Lab., P.O. Box 808 L-321, Livermore, CA 94550). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2507-2509(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

In linear accelerators the maximum achievable beam current is often limited by the Beam Breakup (BBU) instability. The amplitude of this instability depends sensitively on two cavity parameters: the quality factor (Q) which characterizes the damping rate of an oscillator and the transverse shunt impedance (Z/Q) which is a measure of how well the beam couples to the cavity fields of the mode and, in turn, how the fields act back on the beam. It was found, in the experiments reported in this paper, that placing ferrite on the drive blades and back walls of the cavities greatly reduced Q, and that Q was reduced further by placing a reflector in the corner of the accelerator cavities. A summary of the quality factors and transverse shunt impedances for the ETA and ATA cavities determined from bench tests is given. The experimental data, detailed in this paper along with the procedures used, was compared with the results of a computer code which employs the single mode theory of Neil, Hall and Cooper to calculate the growth of the BBU instability. In addition to the parameters Q and Z/Q, each accelerating cavity is characterized, in this code, by the angular frequency of the dominant mode. Results of the comparison are given.

6429 **Beam breakup instability in RF linacs.** Felber, F.S.; Cooper, R.K.; Mitrovich, D.; Wilson, P.B. (Western Research Corp., 8616 Commerce Ave., San Diego, CA 92121). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2513-2515(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The Beam Breakup (BBU) instability appears to be the principal limitation to high current operation of RF linacs. This instability results in the loss of part or all of a beam bunch above a certain current or beyond a certain number of bunches. Even when the bunch is not lost it may be deflected sufficiently far off its axis to become useless for its intended application. This paper presents analytical and numerical calculations of the BBU instability in RF linac cavities which should be useful in scaling RF linacs to high current operation. Analytical calculations for single bunch BBU in pillbox cavities show that the beam deflection scales with the initial deflection, the charge per bunch, the accelerating gradient, the accelerator length, and the cavity wavelength in a manner that can be generalized to include the effects of periodic focusing on transverse emittance growth. Numerical simulations of multibunch BBU show the growth of beam deflection amplitude from wake fields generated by preceding bunches. Wake field calculations using a transverse beam cavity interaction code are presented.

6430 **Application of dynamically consistant closures to hydrodynamic models of beams.** Mark, J.W.K.; Buchanan, H.L.; Yu, S.S. (Lawrence Livermore Nat.'l Lab., Livermore, CA 94550). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2552-2554(Aug 1983). (CONF-830311—). Contract W-7405-ENG-48.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Hydrodynamic models have been used in particle beam research. Sometimes equations of state are assumed by dropping heat fluxes without a detailed attempt to model possible beam behavior such as anisotropic stresses even in the transverse directions. Recently, for the purpose of ion beam inertial fusion research, the authors have shown that dynamically consistent equations of state can be derived from the Vlasov equation for some beam models under the assumption that the particle orbits are allowed to be general rosette orbits in central fields except that the ratio of maximum to minimum radial excursion is limited by something less than a factor of two. They further advised that if the beam has zero net angular momentum then at least two counter-rotating beam components of this type should be considered. By remaining closely tied to the actual particle orbits the possibility of wave-particle resonances typical of resistive-hose instabilities is retained. In this paper the authors discuss the dynamically consistent closure of hydrodynamic models within adiabatic assumptions analogous to that of Chew, Goldberger and Low for magnetohydrodynamics and that of Berman and Mark for galactic dynamics. Numerical comparison with particle codes is discussed for pinched beams.

6431 **Space charge limits in ESQ transport systems.** Maschke, A.W.; Brodowski, J.; Meier, E. (Accelerator Dept., Brookhaven Nat.'l Lab., Assoc. Universities, Inc., Upton, NY 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2558-2559(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

This report describes the results obtained in a series of experiments done with a variety of different electrostatic quadrupole configurations using a precision optical bench system. The performance of a quadrupole transport system can be described by a generalized perveance defined by an equation for the maximum current obtainable for fixed quadrupole and beam parameters as the quadrupole strength is varied. The experiments were done for the most part with singly charged Argon ions (A = 40) with energies of 1 or 2 keV. By varying the beam energy and observing the correct behavior the authors were confident that they were saturating the channel and were not limited at the ion source. Verification runs were also made with Xenon. One possible source of error in the experiment was the impurity of the argon beam. The impurity levels were measured with a magnetic analyzer and the beams were typically found to be over 98% pure. The current limits determined in the experiment were produced with an ion source of the Ehlers type using coated nickel mesh filament. The only experimentally determined numbers were the beam current, the quadrupole voltages and the beam size. Using this data as input into the computer code SCTRAN, it was possible to get plausible estimates of the tune shift and hence the brightness of the beam. The beam at the end of the 40 quad system used about 80% of the available aperture. The beam was perfectly centered and so the failure of the beam to fill the system could not be explained by steering errors.

6432 **Transverse mode coupling in a bunched beam.** Chin, Y.; Satoh, K. (Nat.'l Lab for High Energy Physics, Oho-machi, Tsukuba-gun, Ibaraki-ken 305). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2566-2568(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Since the fast transverse instability was observed in PETRA and, more recently, in PEP, this instability has become a critical problem in the design of large storage rings. The reason is that this instability imposes the serious limitation on a stored current; as soon as the current exceeds the threshold, the bunch distribution begins to blow up vertically or horizontally more rapidly that the synchrotron oscillation, and beam particles are lost. Short range fields created by the beam in RF cavities are considered to play an important role. The fast instability has been explained in terms of mode coupling in the longitudinal phase space or head-tail turbulence by other authors. The purpose of this paper is to derive a formalism of the mode coupling theory for a Gaussian bunch beginning from Sacherer's integral equation. The problem is reduced to solving the determinant equation for eigenfrequencies of coherent oscillations. Eigenfunctions are expressed as superposition of the linear independent functions where higher radial modes and azimuthal modes are combined and rearranged into "hybrid" modes. The theory is applied to explaining the fast instability observed in PEP and to a preliminary estimate of the threshold current in the TRISTAN electron-positron storage ring. The transverse broadband impedances of RF cavities in PEP and TRISTAN are calculated with the program code TBCI and characterized by a single low-Q resonator impedance. A satisfactory agreement with PEP experimental results is obtained.

6433 **A beam current monitor for intense electron beams.** Fiorito, R.B.; Raleigh, M.; Seltzer, S.M. (Naval Surface Weapons Center, White Oak, Silver Springs, Maryland 20910). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2210-2212(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The use of interceptive probes for measuring the current density profile of electron beams is a common technique in accel-

erators producing low current beams. Severe requirements are imposed on interceptive devices when current densities of the order of kiloamperes per square centimeter are encountered. In this case, space charge effects, large secondary electron production, and probe heating are important considerations. This paper describes a simple and fast (pulse rise ca. 0.4 ns) interceptive "electric" probe which can be used in repetitively pulsed intense electron beam accelerators with high current densities. The device is sensitive only to the beam charge present within the probe volume. To accomplish this, the probe uses a "built in" electrostatic shield. The device consists of two parts: a sensor tip made of graphite and a stainless steel support/positioning tube. The entire structure is designed to approximate a "capped off" coaxial transmission line or, in other words, an open-ended but shielded line. The outer conductor constitutes the electrostatic shield. The theory behind the probe is described as well as its performance testing at the Lawrence Livermore Laboratory Experimental Test Accelerator. By mechanically scanning this probe through the beam as a function of radius it was found that the beam current density could be determined.

6434 **Reduction of beam emittance by a tapered-foil technique.** Peterson, J.M. (Lawrence Berkeley Lab., Univ. of CA, Berkeley, CA 94720). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2403-2405(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The transverse emittance of a particle beam can be reduced by means of a transverse energy gradient produced in a tapered energy-loss foil and by manipulation of the dispersion characteristics of the succeeding beam transport system. In spite of the multiple Coulomb scattering in the foil the area in one transverse phase plane can be substantially reduced provided that the incident beam is sufficiently mono-energetic. In the case of negligible multiple scattering the total six-dimensional phase-space volume occupied by the beam is not changed by this process. This paper discusses the method of reducing transverse emittance with and the effects of a tapered energy-loss foil on the phase-space distributions of a particle beam.

6435 **MARYLYE: the Maryland Lie algebraic transport and tracking code.** Douglas, D.R.; Dragt, A.J. (Univ. of Maryland, College Park, Maryland 20742). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2442-2444(Aug 1983). (CONF-830311—). Contract AS05-80ER10666.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

MARYLYE is a Fortran-language beam transport and tracking code developed at the University of Maryland which employs algorithms based on a Lie algebraic formalism for charged particle trajectory calculations and is designed to compute transfer maps for and trace rays through single or multiple beam-line elements. This is done without the use of numerical integration or traditional matrix methods; all nonlinearities, including chromatic effects, through third or octupole order are included. MARYLYE thus includes effects one order higher than those usually handled by existing matrix-based programs. Presently the following beam-line elements are described by MARYLYE: drifts; normal-entry and parallel-faced dipole bends; fringe fields for dipoles; hard-edged magnetic quadrupoles; fringe fields for quadrupoles; hard-edged magnetic sextupoles; hard-edged magnetic octupoles; axial rotations; RF bunchers; and a user specified transfer map through nonlinear terms of degree 3. Particle transport calculations, or ray traces, are carried out at speeds comparable to those of current matrix-based codes.

6436 **An energy independent electron spin precessor.** Norum, B.E.; York, R.C. (Dept. of Physics, Univ. of Virginia, Charlottesville, Virginia 22901). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2921-2922(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The delivery on target of a polarized electron beam from a linear accelerator is straightforward. With circular accelerators this delivery becomes understandably more difficult. In order to maintain the polarization of an electron beam in a circular machine such as a synchrotron or pulse stretcher ring the electron spins must be oriented vertically so as to be parallel to the dominant guide fields. Extraction from these machines occurs in the horizontal plane so the extracted beam retains the vertical polarization. It is generally desirable to have not vertical but longitudinal polarization of the beam at the target; this requires a reorientation of the spins. The straightforward solution to this problem is to put a solenoid in the beam line to precess the spin into the horizontal plane followed by a horizontally deflecting dipole to precess the spin into the momentum direction. The angle of spin precession is energy dependent. What is needed is a method of varying the effective bend angle. One method used with polarized protons from the ZGS at Argonne involved a movable beam line. An alternative method is to utilize the noncommutativity of rotations in three dimensions. To do this requires two or more solenoids and two or more dipoles. This paper discusses the theory and implementation of this method and describes a solenoid-dipole-solenoid-dipole configuration beam line suitable for the 4 GeV electron accelerator proposed by the Southeastern Universities Research Association.

6437 **Subharmonic beam-loading in electron linear accelerators.** Gallagher, W.J. (Boeing Aerospace Co., Seattle, WA 98124). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3019-3020(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The intention of operating an electron linear accelerator subharmonically beam loaded for free electron laser application requires justification of the beam-loaded energy gain equation. The mode of operation typically planned is 5 to 10 nanocoulombs single RF cycle pulses at 25 to 50 nanosecond intervals. This inquiry investigates the details of this sort of beam loading and discusses the performance achievable. Several other investigations of single bunch beam loading have been undertaken, notably at SLAC, where it has been found experimentally that the beam-loading varies directly as the bunch charge and independently of its energy; that investigation also included radiation effects of the wake field and losses owing to parasitic effects of higher order modes. In the case of beam loading where there are multiple pulses transiting at the same time, and spaced far enough apart that significant RF power is introduced between pulses, the energy gain may be calculated by dividing the waveguide into a number of segments, each equal in length to the integral of the interpulse time and the local group velocity. Equations which reveal that the net energy gain in the steady state is the sum of the energy gains in these segments, which compute the initial field intensity, and which calculate the energy gain in the subharmonic case on the basis of the equivalent beam current are presented.

6438 **Stability and signal suppression of Schottky signals from stochastically cooled beams.** Kells, W.P. (Fermi Nat.'l Accelerator Lab., P.O. Box 500, Batavia, IL 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2590-2592(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Several thorough treatments of stochastic cooling now exist which go far beyond the original conceptual picture of "removing fluctuations from the Schottky noise". The trend has been to replace this statistical picture with ensemble evolution equations amenable to continuum treatment. High performance antiproton accumulation systems attempt operation at the limits of system feedback gain as dictated by instability thresholds and signal suppression degradation. The many admitted and implicit assumptions associated with the current models are most questionable near the high gain limit. This paper first highlights a few of these assumptions and points out inconsistencies to which they lead. In particular it reveals a fundamental difference between transverse (including Palmer) cooling and filter cooling. It then points out an alternative for a refined cooling approach called the "renormalization group"

(RG). Instability thresholds may be viewed as phase transitions. The unique success of the RG approach in describing the behavior of systems near phase transitions is well known in other branches of physics. In this paper the author limits himself to making this approach plausible and sketching out its methodology but argues also for a re-examination of a statistical approach to stochastic cooling.

6439 **Fast betatron cooling in the debuncher ring for the Fermilab Tevatron I project.** Autin, B.; Marriner, J.; Ruggiero, A.; Takayama, K. (CERN, 1211 Geneva 23). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2593-2595(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The original function of the Fermilab antiproton debuncher--to compress the momentum spread of the injected antiproton beam using a bunch rotation technique--permits almost all the time between two injections to be employed in cooling the beam transverse emittance. The cooling is stochastic and is designed to reduce the initial emittance by an order of magnitude in two seconds. To achieve this performance, the betatron cooling is handicapped by the low value of the dispersion in revolution frequency with the particle momentum. Indeed, the value of this dispersion has to be kept small, in order to keep the RF voltage required for the bunch rotation within a reasonable limit. Moreover, since the momentum spread is small, a very broad bandwidth (2-4 GHz) is required for efficient sampling of the beam. Betatron cooling of low intensity beams is usually limited by the thermal noise since the signal is naturally weak. Here, however, low thermal noise for the pickup and preamplifier is achieved with cryogenic techniques. Fast cooling requires a high output power for the power amplifiers. The conjunction of high power and broad bandwidth may be excessively uneconomical. It is possible, however, to get reasonable power (500 watts) by using a large number of kicker magnets and by optimizing the gain during cooling. This paper discusses the parameters and also the computer simulations of such a system.

6440 **Electron beam dynamics in the CERN PS.** Baconnier, Y.; Cappi, R.; Garoby, R.; Hardt, W.; Hubner, K.; Madsen, J.H.B.; Riunaud, J.P. (CERN, 1211 Geneva 23). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2613-2615(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The 28 GeV proton synchrotron (PS) forms part of the chain of LEP injectors with the role of accelerating positrons and electrons from 0.6 GeV, the operating energy of the Electron/Positron Accumulator (EPA), to 3.5 GeV, the positron/electron injection energy of CERN's 400 GeV proton synchrotron (SPS) which then accelerates the particle to 20 GeV. Bunch length and energy spread must be chosen carefully to avoid transverse and longitudinal single-bunch instabilities associated with high peak currents in the SPS. An analysis of the beam dynamics in the combined function lattice of the PS shows that this requirement can be fulfilled if the damping-partition numbers are changed. A Robinson Wiggler is proposed for this purpose and a new additional RF system is needed to produce the required bunch dimensions in the longitudinal phase space. In this paper, the required dimensions, including the maximum bunch length, the relative rms energy spread, and the maximum transverse emittance, are derived. Two approaches are proposed for obtaining the proper bunch dimensions: bunch expansion or bunch-length compression.

6441 **A review of the beam breakup problem in linacs.** Gallagher, W.J. (Boeing Aerospace Co., Seattle, WA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2658-2660(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The phenomenon of beam breakup was first observed around 1957 by the then principal industrial fabricators of microwave electron accelerators. Its effect may be described as a progressive shortening of the output beam pulse compared to the injected pulse length with increasing beam current and with the pulse length reduction occurring from the later end of the pulse forward. This paper reviews the research which beam breakup has undergone over the intervening years and summarizes the various attempts made by different scientists and accelerator facilities to explain a mechanism capable of preventing a moderately high energy beam from transmitting the waveguide. It discusses the theoretical and technological investigations into the HEM-II mode and the higher order modes in disk-loaded guides as well as benchmark advances made at accelerators such as the linac at SLAC and the Kharkov machine.

6442 **Theoretical and observed behavior of the Daresbury SRS RF system.** Hughes, E.A. (SERC, Daresbury Lab., Daresbury, Warrington WA4 4AD). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3478-3480(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Theoretical predictions of both the steady-state and transient behaviour of the SRS RF system are presented. These are compared with observed behaviour which includes anomalous steady-state beam loading and phase oscillations of the beam. The steady-state theory is shown to provide an adequate explanation of observations and some conclusions are drawn about beam phase oscillations.

6443 **A three-dimensional field program.** Foss, M.H. (AT-6, MS H829 Los Alamos Nat.'l Lab., Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2856-2858(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The high-energy microtrons studied at ANL require complicated magnetic field configurations. A three-dimensional infinite-permeability magnetic field program was written to show that poles and coils can be devised to produce those fields. The program is in Hewlett-Packard 9845B BASIC which limits the active mesh to about 30,000 points. In some problems the number of useful points can be greatly increased by placing virtual points one plane beyond the active mesh. The regular cubic mesh is described by three arrays: a scalar potential array derived from ampere-turns by using current cuts, an information array, and a list containing other data. This data structure is similar to the Carnegie Magnet Program. An element from the information array usually carries a bit string with directions for calculating the corresponding scalar potential. However, if more data are required, then the word from the information array is interpreted as the address in the list where the required data are stored. Parts of the list can be reused when two or more points require identical data. The program has four parts: the program description file preparation, the starting mesh loading, the mesh relaxation, and the output results. Preliminary runs indicate that the magnet edge can be quite "hard" and suggest that the required field configurations can be produced.

6444 **Dipole shuffling in the Fermilab energy saver.** Michelotti, L.P.; Ohnuma, S. (Fermi Nat.'l Accelerator Lab., P.O. Box 500, Batavia, IL 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2472-2474(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Permuting the magnets in an accelerator can modulate the adverse effects of field errors on particle orbits; imperfections in magnetic fields can be made to cancel one another if some attention is paid to their arrangement. In particular, careful ordering gives a certain measure of control over resonances excited by field nonlinearities. Such considerations were used in assigning superconducting dipoles to the Fermilab Saver. The authors call this activity "shuffling." Magnetic field nonlinearities of all the Saver dipoles were measured at Fermilab's Magnet Test Facility in terms of multipole moments and expressed as "normal" and "skew" harmonic coefficients. Harmonic coefficients associated with a dipole are the weighted averages of three measurements which are formally relat-

ed to resonances in the usual way by treating field nonlinearities as a perturbation in the transverse Hamiltonian of the accelerator. This Hamiltonian is expressed in terms of action-angle variables and is written in a form that emphasizes its resonance structure. Of the coefficients included in this Hamiltonian it is the integral involving lattice functions which "shuffling" attempts to control. In Fermilab's Energy Saver its value is dominated by contributions from the bending magnets. In this paper the intention of the authors is to arrive at a concise mathematical description of this effect.

6445 **A "monochromatic" radio frequency accelerator cavity.** Giordano, S. (Brookhaven Nat.'l Lab., Upton, NY 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3493-3495(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

In circular accelerators and storage rings it is important that any device placed in the beam line be relatively free of spurious resonances. Accelerating RF cavities inherently have an infinite number of spurious modes. The cavity to be described in this paper makes use of certain geometric construction configurations that eliminate all the spurious modes. A cavity was constructed with an accelerating TMolo mode of 90 MHz. Measurements showed that the TMolo mode was essentially unchanged from a conventional cavity but all modes up to 3 GHz were either completely eliminated or reduced by at least 30 db.

6446 **A low coupling impedance double helix structure for use in a ferrite kicker magnet.** Giordano, S. (Brookhaven Nat.'l Lab., Upton, NY 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3496-3498(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

In a machine such as the CBA, the ejection ferrite kicker magnet has a very large longitudinal and transverse coupling impedance which could destroy the beam. Using a double helix structure that surrounds the beam, the beam induced fields are confined within the helix and, therefore, decoupled from the kicker; but at the same time the helix is transparent to the external fields of the kicker. At first, this may seem paradoxical that the helix is opaque to the fields generated inside the structure by the beam and simultaneously transparent to the external fields generated by the kicker.

6447 **Radio-frequency quadrupole vane-tip geometries.** Crandall, K.R.; Mills, R.S.; Wangler, T.P. (AT-1, MS H817 Los Alamos Nat.'l Lab., Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3554-3556(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Radio-frequency quadrupole (RFQ) linacs are becoming widely accepted in the accelerator community. They have the remarkable capability of simultaneously bunching low-energy ion beams and accelerating them to energies at which conventional accelerators can be used, accomplishing this with high transmission efficiencies and low-emittance growths. The electric fields, used for radial focusing, bunching, and accelerating, are determined by the geometry of the vane tips. The choice of the best vane-tip geometry depends on considerations such as the peak surface electric field, per cent of higher multipole components, and ease of machining. The authors review the vane-tip geometry based on the "ideal" two-term potential function and briefly describe a method for calculating the electric field components in an RFQ cell with arbitrary vane-tip geometry. They describe five basic geometries and use the prototype RFQ design for the Fusion Materials Irradiation Test (FMIT) accelerator as an example to compare the characteristics of the various geometries.

6448 **Design of RFQ vane tip to minimize sparking problems.** Chidley, B.G.; Lee-Whiting, G.E.; McMichael, G.E. (Atomic Energy of Canada Limited, Research Company, Chalk River Nuclear Laboratories, Chalk River, Ontario KOJ 1JO). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3560-3562(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Transverse and longitudinal focusing in radiofrequency quadrupole (RFQ) accelerators depends on V/R /SUB o/ (the vane voltage divided by the mean radial aperture). For maximum current carrying capacity, one generally designs for maximum V/R /SUB o/ , which is limited by the peak surface electric field that can be sustained without sparking. The value of the enhancement factor depends on the pole geometry and can be minimized by choosing an appropriate pole shape. A computer program POTRFQ is described which derives the field potential and the vane tip contour for a range of input parameters. The effects on the beam dynamics of the higher multipole components resulting from the modified pole shapes will also be presented.

6449 **Linac technology for free-electron lasers.** Cooper, R.K. (Los Alamos National Laboratory, NM (USA)); Morton, P.L.; Wilson, P.B. (Stanford Linear Accelerator Center, CA (USA)); Keefe, D.; Faltens, A. (Lawrence Berkeley Laboratory, CA (USA)). *Journal de Physique (Paris), Colloque;* 185-200(1983). (CONF-820988—).

From Free electron laser conference; Bendor, France (26 Sep 1982).

The purpose of this paper is to concentrate on the properties of high-energy electron linear accelerators for use in free-electron lasers operating principally in the Compton regime. To fix our focus somewhat, we shall consider electron energies in the 20- to 200-MeV range and consider requirements for high-power free-electron lasers operating in the 0.5- to 10-μm range. Preliminary remarks are made on high-power free-electron laser amplifiers and oscillators and some desirable characteristics of the linacs that deliver electron beams for these devices. Both the high peak-current requirements of the amplifier and the high pulse-repetition frequency requirements of the oscillator can be met by present-day linac technology, although not necessarily by the same machine. In this papers second and third section, the technology of two rather different types of linear accelerators, the rf linac and the induction linac, is reviewed. In conclusion, applications to the Free Electron Lasers are stated.

6450 **High-power pulsed ion beam acceleration and transport.** Humphries, S. Jr.; Lockner, T.R. (Sandia National Laboratories, Albuquerque, New Mexico). *Advances in Electronics and Electron Physics, Supplement;* **13**: No. C1, 389-444(1983). Contract AC04-76DP00789.

Beam neutralization in ion accelerators is reviewed. Space charge and multigap effects are considered. (AIP)

6451 **Collective acceleration of ions by an intense relativistic electron beam.** Olson, C.L. (Sandia National Laboratories, Albuquerque, New Mexico). *Advances in Electronics and Electron Physics, Supplement;* **13**: No. C1, 445-530(1983). Contract AC04-76DP00789.

The theory and design of collective accelerators are reviewed. Specific accelerators considered include the ioniation front, plasma-controlled, and helix-controlled devices. (AIP)

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 6358, 6421, 6424, 6425, 6426, 6431, 6433, 6438, 6450, 6451, 6547

6452 **(BNL—33814) Possibilities for relativistic heavy ion collisions at Brookhaven.** Barton, M.O.; Hahn, H. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 18p. (CONF-8309168—3). NTIS, PC A02/MF A01. Order Number DE84002865.

From 3. international conference on ultra-relativistic nucleus-nucleus collisions; Upton, NY, USA (26 Sep 1983).

Since 1980 there has been considerable interest at Brookhaven in exploiting the existence of the Colliding Beam Accelerator, CBA, earlier referred to as Isabelle, for the generation of heavy ion collisions at very high energies. The only requirement for a heavy ion collider would have been for an energy booster for the Tandem accelerator and a tunnel and magnet transport system to the AGS. For a few million dollars heavy ions up to nearly 200 GeV/amu could be collided with luminosities of 10^{27} to 10^{28}/cm^2 sec in experimental halls with ideal facilities for heavy ion physics studies. Although the CBA project has been stopped, it is still true that Brookhaven has in place enormous advantages for constructing a heavy ion collider. This paper describes a design that exploits those advantages. It uses the tunnel and other civil construction, the refrigerator, vacuum equipment, injection line components, and the magnet design for which there is expertise and a production facility in place. The result is a machine that appears quite different than would a machine designed from first principles without access to these resources but one which is of high performance and of very attractive cost.

6453 **(BNL—33874) Storage ring design for x-ray lithography.** van Steenbergen, A.; Grobman, W. (Brookhaven National Lab., Upton, NY (USA); IBM Watson Research Center, Yorktown Heights, NY (USA)). 1983. Contract AC02-76CH00016. 12p. (CONF-8310172—9). NTIS, PC A02/MF A01. Order Number DE84002859.

From Advances in soft x-ray science and technology conference; Upton, NY, USA (17 Oct 1983).

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The design of an electron storage ring for Industrial x-ray Lithography is examined and a parameter optimization carried out based on a model lithography system in use at the National Synchrotron Light Source at Brookhaven National Laboratory. In this optimization the potential use of superconducting or permanent magnet wigglers is considered. The basic parameters and geometry of a number of t(exposure) = 5 sec., λ (operating) = 8.26 A devices are presented.

6454 **(CAPE—2911) SLAC Master Trigger Generator (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). 24 Aug 1973. Contract AC03-76SF00515. TIC, PO Bx 62, Oak Ridge, TN 37831.

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The schematic diagrams (SD 130-005 -R1 Schematic Diagram Mk IV Mod A, and SD 130-081-00-R1 Schematic Diagram 1972 Version) and block diagram (BD 130-007 -R1 Block Diagram) of the Master Trigger Generator give the electronic details of two of these devices used on the SLAC Two-Mile Linear Accelerator. The device is designed to provide a trigger to all of the accelerator's parts including the research areas. This trigger times the modulators, the rf pulses, and the experiment detectors. There are other parts of the Master Trigger System which provide transfer to another unit in case of failure and level control. These latter drawings are not included nor are the subdrawings associated with the listed schematic drawings.

6455 **(CAPE—2913) SLAC PEP optical monitor region 7 (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). Nov 1983. Contract AC03-76SF00515. TIC, PO Bx 62, Oak Ridge, TN 37831.

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The drawings listed on the Auxiliary Drawing List provide some layout and construction data for the synchrotron light monitor beam line assembly. Not all the subdrawings are included. The assembly provides a means for extracting and viewing the synchrotron light from the stored beam in PEP. This information is used to provide diagnostic information as well as a visual TV type presentation of the beam profile or on a conventional oscilloscope screen. Much electronics is necessary for these functions, but has not been included with this set of drawings.

6456 **(CAPE—2914) SLAC SPEAR 4.5 GeV RF accelerator section for locations 6S7 and 7S8 (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). 22 Nov 1983. Contract AC03-76SF00515. TIC, PO Bx 62, Oak Ridge, TN 37831.

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The assembly drawing of the RF accelerator cavities provide overall and layout information of the cavities as used on SPEAR at 6S7 and 7S8. No subdrawings or details are included. These cavities are used to supply energy lost to synchronotron radiation from the beam as it circulates around the storage ring. The cavity frequency is 358 MHz.

6457 **(CAPE—2915) SLAC accelerator to PEP ring tunnel layouts with selected component layouts (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). 22 Nov 1983. Contract AC03-76SF00515. TIC, PO Bx 62, Oak Ridge, TN 37831.

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The listed drawings provide the information on the two injector tunnels from the SLAC Linear Accelerator to the PEP Storage Ring. Some data is included delineating the beam line and major components thereof. Penetrations to the housings or tunnels and the shape and size of these particular areas are indicated.

6458 **(CAPE—2916) SLAC MARK III layout and selected subcomponents (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). 29 Nov 1983. Contract AC03-76SF00515. TIC, PO Bx 62, Oak Ridge, TN 37831.

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The drawings listed on the auxiliary drawing list provide the overall layout of the MARK III Detector and selected peripheral assemblies used on the SLAC SPEAR Storage Ring. This group of drawings provide some data on drift chamber assemblies, magnetic shields, time-of-flight scintillator-counter, shower counter feedthroughs, vacuum pipe tooling, flip-flop table, muon detector steel plates and miscellaneous tooling and fixtures. These devices are but a small part of the MARK III Detector used on the SLAC SPEAR Storage Ring. The detector is located at one of the interaction regions and serves to detect various phenomenon arising from electron-positron collisions.

6459 **(CAPE—2917) SLAC accelerator degaussing system (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). 9 Dec 1983. Contract AC03-76SF00515. TIC, PO Bx 62, Oak Ridge, TN 37831.

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The listed assembly drawings provide the general construction, outline and assembly methods of the 40-foot accelerator girder unit. The unit consists of the support girder (light pipe), the accelerator disk-loaded wave guides, and the degaussing system. Water circuits and other details are shown. These drawings do not show details and the detail drawings are not included. The 2-foot diameter 40-foot girder supports the accelerator and provides a vacuum space for the laser alignment system.

6460 **(CAPE—2918) SLAC MARK II detector vacuum chamber layout including selected vacuum subcomponents (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). 29 Nov 1983. Contract AC03-76SF00515. TIC, PO Bx 62, Oak Ridge, TN 37831.

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The listed drawings provide generally overall outline data of several parts of the vacuum chamber of the MARK II Detector as used at the SLAC PEP Storage Ring. The parts or devices in this group of drawings include the outlines/layouts for the main vacuum chamber, the counter tube shield, the luminosity counter chamber, the radiation mask and the small angle target (S.A.T.). The subdrawings (details) of the listed drawings are not included.

6461 (CAPE—2919) SLAC PEP hot water bakeout supply trailer plan (Engineering Materials). (Stanford Linear Accelerator Center, CA (USA)). 2 Dec 1983. Contract AC03-76SF00515. TIC, PO Bx 62, Oak Ridge, TN 37831.

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The trailer plan layout drawing provides the basic information for designing a trailer with a hot water bakeout system, controls and connections for baking out parts of the PEP storage ring vacuum components. The trailer and its assemblies can be moved to selected areas of the storage ring for bakeout of the vacuum system in that area. It uses a hot water generator as defined in SLAC PS 200 00 R1 as purchased from a commercial company.

6462 (CAPE—2920) SLAC DELCO I and DELCO II detector magnet assembly (Engineering Materials). (Stanford Linear Accelerator Center, CA (USA)). 2 Dec 1983. Contract AC03-76SF00515. TIC, PO Bx 62, Oak Ridge, TN 37831.

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The drawings listed on the auxiliary drawing list provide the data and specifications for constructing the DELCO I/II spectrometer detector magnet as used at the SPEAR and presently at the PEP storage ring. As used on DELCO I the coils were aluminum. When it was modified to DELCO II, copper coils were used to provide the same field with a larger gap with the same power requirements. Specifications are: Field 3 to 4 kG, Gap 33.5 in, Power 360 kW, Current 3000 A, and Coolant flow 30 gal/min.

6463 (CAPE—2921) SLAC quadrupole magnet measuring assembly (Engineering Materials). (Stanford Linear Accelerator Center, CA (USA)). 2 Dec 1983. Contract AC03-76SF00515. TIC, PO Bx 62, Oak Ridge, TN 37831.

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The assembly drawing listed provides the information for constructing a quadrupole measuring assembly that was used to measure the PEP main ring quadrupoles for proper characteristics. The assembly consists of a frame that straddles the magnet and supports a long rotating coil through the magnet. A computer program controls the coil and detects the output of the coil, analyzes it for harmonics, and then produces a curve and/or a printout which then can be analyzed for tolerances and quality of the magnet.

6464 (CONF-830576—15) Plans for data acquisition for the new accelerator, ATLAS. Welch, L.C. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 14p. NTIS, PC A02/MF A01. Order Number DE84003615.

From Real-time computer applications in nuclear and particle physics conference; Berkeley, CA, USA (16 May 1983).

ATLAS is a heavy-ion accelerator currently under construction at Argonne. It will be a national facility providing beam energies of up to 25 MeV/A with a relative beam spread of less than 10^{-4} and a time spread of less than 25 psec. It is anticipated that the research capabilities offered by ATLAS will attract a large number of outside users and that the experimental requirements for data acquisition will exceed the capabilities of the present system, SNAP. Plans are presented for providing a user friendly, flexible and fast CAMAC data acquisition system to cater to the demands of the next generation of experiments at Argonne.

6465 (CONF-831012—7) Non-reactor neutron irradiation facility: the Argonne Intense Pulsed Neutron Source. Birtcher, R.C.; Scott, T.L. (Argonne National Lab., IL (USA)). Oct 1983. Contract W-31-109-ENG-38. 9p. NTIS, PC A02/MF A01. Order Number DE84003456.

From International symposium on use and development of low and medium flux research reactors; Cambridge, MA, USA (17 Oct 1983).

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A new generation of neutron sources is just coming into existence with great promise for the future. These sources are based on neutron production by spallation from the interaction of high energy protons with a heavy metal target. Currently the highest flux facility of this type is the Intense Pulsed Neutron Source at Argonne National Laboratory. This machine is also unique in its dedication to both slow-neutron scattering and fast-neutron damage studies.

6466 (CONF-831025—25) Utilization of the intense pulsed neutron source (IPNS) at Argonne National Laboratory for neutron activation analysis. Heinrich, R.R.; Greenwood, L.R.; Popek, R.J.; Schulke, A.W. Jr. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01. Order Number DE84003619.

From 26. ORNL-DOE conference on analytical chemistry in energy technology; Knoxville, TN, USA (11 Oct 1983).

The Intense Pulsed Neutron Source (IPNS) neutron scattering facility (NSF) has been investigated for its applicability to neutron activation analysis. A polyethylene insert has been added to the vertical hole VT3 which enhances the thermal neutron flux by a factor of two. The neutron spectral distribution at this position has been measured by the multiple-foil technique which utilized 28 activation reactions and the STAYSL computer code. The validity of this spectral measurement was tested by two irradiations of National Bureau of Standards SRM-1571 (orchard leaves), SRM-1575 (pine needles), and SRM-1645 (river sediment). The average thermal neutron flux for these irradiations normalized to 10 μamp proton beam is 4.0×10^{11} n/cm^2-s. Concentrations of nine trace elements in each of these SRMs have been determined by gamma-ray spectrometry. Agreement of measured values to certified values is demonstrated to be within experiment error.

6467 (CONF-8309156—13) Preliminary tests of a second harmonic rf system for the intense pulsed neutron source synchrotron. Norem, J.; Brandeberry, F. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01. Order Number DE84003595.

From 7. meeting of the international collaboration on advanced neutron sources; Ontario, Canada (12 Sep 1983).

The Rapid Cycling Synchrotron (RCS) of the Intense Pulsed Neutron Source (IPNS) operating at Argonne National Laboratory is presently producing intensities of 2 to 2.5×10^{12} protons per pulse (ppp) with the addition of a new ion source. This intensity is close to the space charge limit of the machine, estimated at $\sim 3 \times 10^{12}$ ppp, depending somewhat on the available aperture. Accelerator improvements are being directed at (1) increasing beam intensities for neutron science, (2) lowering acceleration losses to minimize activation, and (3) gaining better control of the beam so that losses can be made to occur when and where they can be most easily controlled. We are now proposing a third cavity for the RF system which would provide control of the longitudinal bunch shape during the cycle which would permit raising the effective space charge limit of the accelerator and reducing losses by providing more RF voltage at maximum acceleration. This paper presents an outline of the expected benefits together with recent results obtained during low energy operation with one of the two existing cavities operating at the second harmonic ($2f_0$).

6468 (CONF-8309156—14) Measurement and fitting of spectrum and pulse shapes of a liquid methane moderator at IPNS. Carpenter, J.M.; Robinson, R.A.; Taylor, A.D. (Argonne National Lab., IL (USA); Los Alamos National Lab., NM (USA); Rutherford Appleton Lab., Chilton (UK)). 1983. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01. Order Number DE84003678.

From 7. meeting of the international collaboration on advanced neutron sources; Ontario, Canada (12 Sep 1983).

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We have measured the absolute intensity, and the energy spectrum, and the pulse shapes as function of neutron energy for the IPNS liquid CH_4 F moderator, at 108 K. We have fitted the spectrum, corrected for attenuation by aluminum in the beam, using a new cutoff function and fitted the pulse shapes to a new function which is the sum of two decaying exponentials, convoluted with a gaussian, and determined the wavelength variation of the parameters. We present here the results of a preliminary analysis.

6469 (DOE/ER/40058—1, pp 427-429) **Intense source of monochromatic photons.** Orphanos, L.; McCarthy, J.; Norum, B.; York, R. (Univ. of Virginia, Charlottesville). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

An alternative means of creating intense beams of monochromatic high-energy photons is through the reaction $e^+e^- \rightarrow \gamma\gamma$. At high energies ($\beta \rightarrow 1$)$d\sigma/d\Omega$ is seen to peak at $x = 1$ ($\theta = 0$). The photon energy also peaks at $x = 1$, when $\beta \rightarrow 1$. Hence, e^+e^- annihilation can provide intense beams of high-energy photons in the forward direction, which over a sufficiently small angular range are nearly monochromatic. The photon beam will be prepared according to the following scheme: (1) High-energy positrons (0.5 to 4.0 GeV) are injected into the general-purpose ring (GPR). (2) A supersonic jet of H_2 gas is injected transverse to the e^+ beam; the atomic electrons provide an e^- target for the positrons. (3) The e^+ beam is bent just after the point of interaction, and the forward-directed photons escape through an aperture in the GPR.

6470 (DOE/ER/40058—1, pp 548-550) **Planned physics program for the MAX accelerator.** Schroder, B. (Univ. of Lund, Sweden). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

The main research activities at MAX are expected to be research with synchrotron light and nuclear physics research. In this note only the latter part will be covered. Several experimental situations which will be available at MAX are reviewed. The interest in using MAX for nuclear physics research is, however, at present limited and it is thus uncertain if the full potential of the system will be employed.

6471 (LA-UR—83-3200) **Status report on the WNR/PSR pulsed spallation neutron source at the Los Alamos National Laboratory.** Bowman, C.D. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 7p. (CONF-8309156—12). NTIS, PC A02/MF A01. Order Number DE84003782.

From 7. meeting of the international collaboration on advanced neutron sources; Ontario, Canada (12 Sep 1983).

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Much progress has been made in WNR/PSR facility development and in planning and implementing a full research program since the last ICANS meeting. Construction of the PSR continues on schedule, a significant neutron scattering research program is under way at the WNR that can continue through the construction period, and a formal neutron scattering user program was begun this year. The problem of bothersome backgrounds at the WNR has been solved, and a versatile and effective target-moderator design has been developed. Plans are being implemented for spectrometer construction, data collection and analyses facilities, and a major augmentation in experimental space.

6472 (LA-UR—83-3246) **Scaled, circular-emitter Penning SPS for intense H^- beams.** Smith, H.V. Jr.; Allison, P.; Sherman, J.D. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 6p. (CONF-831180—6). NTIS, PC A02/MF A01. Order Number DE84003805.

From 3. international symposium on the production and neutralization of negative ions and beams; Upton, NY, USA (14 Nov 1983).

The Los Alamos versions of the Penning Surface-Plasma Source (SPS) routinely generate H^- ion beams with pulsed currents over 100 mA. However, these sources employ geometries that result in the extraction of slit beams (0.5 x 10 mm^2). Our modeling with the SNOW code indicates that the beam from a 5.4-mm-diam circular emitter will have lower emittance and divergence for transport to and injection into our radio-frequency quadrupole (RFQ) accelerator. This paper describes a newly constructed Penning SPS that has most of its discharge chamber dimensions scaled up by a factor of 4 to accommodate this circular emitter.

6473 (LA-UR—83-3254) **Operating experience with a 100-keV, 100-mA H^- injector.** Allison, P.W.; Sherman, J.D. (Los Alamos Scientific Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 9p. (CONF-831180—9). NTIS, PC A02/MF A01. Order Number DE84003800.

From 3. international symposium on the production and neutralization of negative ions and beams; Upton, NY, USA (14 Nov 1983).

According to beam dynamics calculations it should be possible to accelerate a high-perveance beam in a radio-frequency quadrupole (RFQ) accelerator with low emittance growth and nearly 100% capture efficiency. A 100-mA, 100-keV H^- ion injector with a 5-Hz, 1-ms duty factor was built for use with this accelerator, but the beam emittance at 100 keV was found to be two to four times the value previously determined at 20 keV. This emittance growth was traced to the 20-keV beam transport, where an instability occurred in the background plasma created by beam ionization of the residual gas. The injector has been rebuilt with a shorter transport length, resulting in greatly reduced emittance growth.

6474 (LA-UR—83-3273) **Development of a multicusp H^- ion source for accelerator applications.** York, R.L.; Stevens, R.R. Jr. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 8p. (CONF-831180—5). NTIS, PC A02/MF A01. Order Number DE84003797.

From 3. international symposium on the production and neutralization of negative ions and beams; Upton, NY, USA (14 Nov 1983).

The development of a multicusp surface-production H^- ion source (Berkeley concept) designed specifically for accelerator use is described. The goal of this development effort has been to provide a suitable H^- ion source for the Proton Storage Ring now being constructed at LAMPF. The ion source that has been developed is now capable of long-term operation at 20 mA of H^- current at 10% duty factor and with normalized beam emittance of 0.13 cm-mrad (95% beam fraction). The development program will be described with particular emphasis on beam emittance measurements.

6475 (LA-UR—83-3288) **Linac-driven XUV free-electron laser.** Newnam, B.E.; Goldstein, J.C.; Fraser, J.S.; Cooper, R.K. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 24p. (CONF-8309118—4). NTIS, PC A02/MF A01. Order Number DE84003798.

From Topical meeting on free electron generation of extreme ultraviolet coherent radiation; Upton, NY, USA (19 Sep 1983).

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Use of an rf linear accelerator as the electron source for a free-electron laser operating in the extreme ultraviolet wavelength range from 100 nm to at least as low as 50 nm appears feasible. Peak and average power outputs of greater than 100 kW and 50W, respectively, are predicted.

6476 (LBL—16506) **LBL program of 1 meter long, 50 mm diameter bore, dipoles with fields greater than 8 tesla.** Hassenzahl, W.; Gilbert, W.; Taylor, C.; Meuser, R. (Lawrence Berkeley Lab., CA (USA)). Aug 1983. Contract AC03-76SF00098. 7p. (CONF-830822—42). NTIS, PC A02/MF A01. Order Number DE84002902.

From 12. international conference on high energy accelerators; Batavia, IL, USA (11 Aug 1983).

Model dipole superconducting magnets with central fields above 8 tesla are being developed for future multi-TeV colliding beam accelerators. The first three models are 1 meter long, have nominal 50 mm diameter cold bores, and utilize Nb-Ti superconductor operating in He II at 1.8 K. None of the three models had an iron flux-return yoke. The maximum central fields achieved are 8.0, 8.6, and 9.1 tesla - all short-sample performance at 1.8 K for the conductors used. At 4.3 K the maximum central fields are from 1.5 to 2.0 tesla lower. In one design, the superconductor is arranged in four concentric cylindrical layers, sometimes called a four-shell geometry. With higher current density Nb-Ti we expect this design to reach 10 tesla central field and a two layer design to reach 8 tesla. The other design uses 8 flat pancakes with upturned ends. Improved Nb-Ti should also allow this design to reach 10 tesla central

field. This geometry is being used for our Nb_3Sn wind-and-react dipole to be operated in He I at 4.3 K.

6477 **(LBL—16641) Polarization characteristics of synchrotron radiation sources and a new two undulator system.** Kim, K.J. (Lawrence Berkeley Lab., CA (USA)). Sep 1983. Contract AC03-76SF00098. 14p. (CONF-830910—9). NTIS, PC A02/MF A01. Order Number DE84002906.

From 3. national conference on synchrotron radiation instrumentation; Upton, NY, USA (12 Sep 1983).

The polarization properties of the usual synchrotron radiation sources are briefly reviewed. The recently proposed two undulator system can provide synchrotron radiation with arbitrarily adjustable polarization. The characteristics of this device both as a source of spontaneous radiation and also as a free electron laser system are discussed.

6478 **(SLAC-PUB—3217) Models and simulations.** Lee, M.J.; Sheppard, J.C.; Sullenberger, M.; Woodley, M.D. (Stanford Linear Accelerator Center, CA (USA)). Sep 1983. Contract AC03-76SF00515. 8p. (CONF-8309144—8). NTIS, PC A02/MF A01. Order Number DE84003519.

From EPS conference on computing in accelerator design and operation; Berlin, F.R. Germany (20 Sep 1983).

On-line mathematical models have been used successfully for computer controlled operation of SPEAR and PEP. The same model control concept is being implemented for the operation of the LINAC and for the Damping Ring, which will be part of the Stanford Linear Collider (SLC). The purpose of this paper is to describe the general relationships between models, simulations and the control system for any machine at SLAC. The work we have done on the development of the empirical model for the Damping Ring will be presented as an example.

6479 **(SLAC-PUB—3218) Centralized digital control of accelerators.** Melen, R.E. (Stanford Linear Accelerator Center, CA (USA)). Sep 1983. Contract AC03-76SF00515. 11p. (CONF-8309144—6). NTIS, PC A02/MF A01. Order Number DE84003518.

From EPS conference on computing in accelerator design and operation; Berlin, F.R. Germany (20 Sep 1983).

In contrasting the title of this paper with a second paper to be presented at this conference entitled Distributed Digital Control of Accelerators, a potential reader might be led to believe that this paper will focus on systems whose computing intelligence is centered in one or more computers in a centralized location. Instead, this paper will describe the architectural evolution of SLAC's computer based accelerator control systems with respect to the distribution of their intelligence. However, the use of the word centralized in the title is appropriate because these systems are based on the use of centralized large and computationally powerful processors that are typically supported by networks of smaller distributed processors.

6480 **(TRI-PP—83-99) TRIUMF thermal neutron facility.** Thorson, I.M.; Burgerjon, J.J.; Blaby, R.E.; Hodges, T.A. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). Sep 1983. 3p. (CONF-8309156—10). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84900497.

From 7. meeting of the international collaboration on advanced neutron sources; Ontario, Canada (12 Sep 1983).

The TRIUMF Thermal Neutron Facility (TNF) has been described previously, as it was originally installed for operation in 1978. In the January/March 1983 shutdown of the TRIUMF facility the moderator assembly and target were replaced to increase the beam current dissipation capability of the facility in anticipation of increased currents from the 500 MeV isochronous cyclotron. This report will outline these modifications, and others aimed at increasing the overall operating reliability of the TNF. Some preliminary commissioning test results of the molten target temperature distribution are also reported.

6481 **(TRI-PP—83-103) TRIUMF kaon factory as a potential neutron source.** Blackmore, E.W. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). Sep 1983. 5p. (CONF-8309156—9). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84900496.

From 7. meeting of the international collaboration on advanced neutron sources; Ontario, Canada (12 Sep 1983).

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TRIUMF is considering the construction of a kaon factory post-accelerator to take the present 100 μA proton beam (6×10^{14} p/s) from 500 MeV to energies in the range of 15 to 30 GeV. This facility would produce secondary beams of kaons, antiprotons, neutrinos and other particles with an intensity of the order of 100 times present accelerators and would open up new fields in both nuclear and particle physics in the same way that the meson factories LAMPF, SIN and TRIUMF have done at sub-GeV energies. Although the production of neutron beams is not one of the prime motivations for constructing this facility, the high proton currents, in particular from the booster stage of acceleration, would make a unique spallation neutron source. This paper gives a brief report on the status of the kaon factory accelerator studies and describes the parameters of the proton beams which could be made available for neutron production.

6482 **Characteristics of the neutral beam injectors for the Tandem Mirror Experiment Upgrade.** Orzechowski, T.J.; Carter, M.R.; Munger, R.H. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Review of Scientific Instruments;* **54**: No. 12, 1615-1622(Dec 1983). Contract W-7405-ENG-48.

Neutral beams are used to fuel and heat the Tandem Mirror Experiment Upgrade (TMX—U) at LLNL. We have studied these beams spectroscopically to determine their species mix (H, H_2, H^+_3) and impurity content (H_2O). From the shapes of the spectral lines, we measured the divergences of the various components and compared them with the numerically determined divergence. By measuring the area under the various Doppler-shifted lines, we determined the species mix and found that the atomic species fraction is lower than expected (30% to 45% rather than 60%). Although there is good agreement between the measured and calculated divergence for the atomic component of the beam, the molecular components have larger divergences, part of which can be accounted for by the dissociation of the molecules.

6483 **Studies of the effects of a long pulse electron beam on the autoaccelerator.** Lockner, T.R.; Friedman, M.; Palmadesso, P.; Kusse, B.R. (Naval Research Laboratory, Washington, DC 20375). *Journal of Applied Physics;* **54**: No. 11, 6160-6174(Nov 1983).

The propagation of a long pulse (600—800 ns) electron beam in an evacuated drift tube and accelerator gap geometries has been studied. Particular attention has been focused on the drift tube and gap surfaces since formation of plasma here will effect the operation of accelerators such as the Autoaccelerator. Experimental evidence of energetic electron and ion flux to the wall have been obtained. These and other measurements have led to a model describing the space-charge neutralization of the beam and its effect on accelerator operation.

6484 **Sources of electron contamination for the Clinac-35 25-MV photon beam.** Petti, P.L.; Goodman, M.S.; Sisterson, J.M.; Biggs, P.J.; Gabriel, T.A.; Mohan, R. (Department of Physics and Cyclotron Laboratory, Harvard University, Cambridge, Massachusetts 02138). *Medical Physics;* **10**: No. 6, 856-861(Nov 1983). Contract AC02-76ER03064.

A detailed Monte Carlo approach has been employed to investigate the sources of electron contamination for the 25-MV photon beam generated by Varian's Clinac-35. Three sources of contamination were examined: (a) the flattening filter and beam monitor chamber, (b) the fixed primary collimators downstream from the monitor chamber and the adjustable photon jaws, and (c) the air volume separating the treatment head from the observation point. Five source-to-surface distances (SSDs) were considered for a single field size, 28 cm in diameter at 80 cm SSD. It was found that for small SSDs (80—100 cm), the dominant sources of electron

contamination were the flattening filter and the beam monitor chamber which accounted for 70% of the unwanted electrons. Thirteen percent of the remaining electrons originated in the downstream primary collimators and the photon jaws, and 17% were produced in air. At larger SSDs, the fraction of unwanted electrons originating in air increased. At 400 cm SSD, 61% of the contaminating electrons present in the beam were produced in air, 34% originated in the flattening filter and beam monitor chamber, and 5% were due to interactions in the fixed collimators downstream from the monitor chamber and the adjustable photon jaws. These calculated results are substantiated by recent experiments.

6485 **Pulsed beam chopper for the PSR at LAMPF.** Lunsford, J.S.; Hardekopf, R.A. (AT-3, MS H808, Los Alamos Nat.'l Lab., Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2830-2832(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A traveling-wave beam chopper has been designed to provide properly structured negative-ion beam to the Proton Storage Ring (PSR) and other LAMPF users. The chopper must provide a 20-mrad kick with pulse rise time <5 ns for the 750-keV H^- ions in the injector transport line. Variable pulse lengths from 15 ns to 750 μs at repetition rates up to 16.7 MHz must be generated in synchronization with the PSR circulation frequency. Parameter studies led to an optimized design combining good deflection efficiency and bandwidth with minimum deleterious effects from plateto-plate coupling. Both positive and negative 600-V pulses, with lengths up to 1 ms and maximum 10% duty factor, can be generated to drive the deflectors.

6486 **Recent developments of beam dumps and targets at the SPS.** Bellone, R.; Ijspeert, A.; Sievers, P. (CERN, 1211 Geneva 23). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2841-2843(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Proton intensities of about three times the original design value of 10^{13} protons/pulse (ppp) have recently been achieved in the CERN-SPS. Failures due to the resulting elevated energy deposition densities in targets and absorbers are reported and the design and construction of new, fail safe equipment is described.

6487 **Electrode shaping for ion and electron extractions.** Schneider, J.D.; Armstrong, D.D. (AT-4 MS A821, Los Alamos Nat.'l Lab., Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2844-2846(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A technique has been developed that defines the shapes of electrodes needed to produce a good-quality cylindrically symmetric beam of ions or electrons. This work was motivated by the need to optimize electrode shapes for a high-brightness, low-energy, deuteron injector. Experience had indicated that correct shaping of electrodes becomes increasingly important as beam perveance increases. This provided the motivation for developing a computer program that could specify electrodes producing optimum or improved beam quality. Several techniques have been developed and evaluated. The procedure described here has been very successful in meeting design goals.

6488 **Lambertson magnet design for the Tevatron extraction channel.** May, M.P.; Harrison, M.A. (Fermi Nat.'l Accelerator Lab., P.O. Box 500, Batavia, IL 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2836-2837(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The beam splitting requirements of the Tevatron extraction system necessitated the design of two different high field (11 kG and 15 kG) magnetic septa. The authors present details of the magnet design with emphasis on the construction techniques used to achieve good vacuum behaviour and septum straightness while maintaining magnetic field quality.

6489 **Characteristics and transport of a proton beam generated in a linear induction accelerator.** Roth, I.S.; Nation, J.A. (Laboratory of Plasma Studies and School of Electrical Engineering, Cornell University, Ithaca, New York 14853). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2853-2855(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A seven Ohm Blumlein has been used to generate a proton beam in an induction linac using a single magnetically insulated accelerating gap. The proton beam generated has an energy of up to 1.3 MeV at 4.0 kA and a pulse duration of 50 nsec. In this paper the authors report measurements of the beam characteristics and beam transport. Lack of complete neutralization was apparent and a modified system which relies on collective focusing of the ion beam by an electron cloud in an axial magnetic field has been developed. First results obtained using the collective focusing show evidence of improved transport over, at least, short distances. Further measurements are needed to confirm the adequacy of the present system for transport over the scale lengths needed for a multi-gap accelerator.

6490 **Transport in rectangular quadrupole channels.** Meier, E. (Accelerator Dept., Brookhaven Nat.'l Lab., Upton, NY 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2555-2557(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Multiple electrostatic quadrupole arrays can be produced in many different geometries. However, the fabrication process can be considerably simplified if the poles are rectangular. This is especially true for millimeter sized channels. This paper presents the results of a series of measurements comparing the space charge limits in cylindrical and rectangular quadrupole channels.

6491 **Vertical instability in KEK booster.** Suetake, M. (Nat.'l Lab. for High Energy Physics, Oho-machi, Tsukuba-gun, Ibaraki-ken 305). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2569-2570(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

In the KEK Booster Synchrotron, from one msec after injection to extraction timing, beam intensity is stable, though it is reduced to about one half during one msec after injection. An instability of the vertical direction is one of the candidates of the beam loss. The e-folding time of the instability is less than 0.1 msec, and it strongly depends on the beam intensity and the horizontal beam position. The authors found that the instability occurred at 30 MHz and its bandwidth (FWHM) was 15 MHz, that the broad band coupling impedance resulted from several narrow band resonators, and that these resonators were ferrite core bump magnets and kicker magnets.

6492 **Single pass antiproton beam diagnostics of the CERN PS accelerator complex.** Cyvogt, G.; Frammery, B.; Krusche, A.; Maccaferri, R.; Ruette, M.; Schneider, G.C.; Schulte, E. (CERN, Geneva). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2167-2169(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The beam characteristics of every $\bar{}$p bunch in the transfer lines and the CPS can be acquired by various monitors during a single pass and the information stored. The signals emanate from high sensitivity transformers, pick-ups, secondary emission grids and TV screens. After fast analysis and treatment the beam intensity, trajectory (positions), shape, transverse and longitudinal distributions are displayed in analog and/or digital form. Multiple shot storage is provided for some of these parameters. This paper de-

scribes the monitors and the signal processing, gives the special features of the storage systems, and presents typical results.

6493 **An ionization profile monitor for the Brookhaven AGS.** Weisberg, H.; Gill, E.; Ingrassia, P.; Rodger, E. (Brookhaven Nat.'l Lab., Upton, NY 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2179-2181(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A non-destructive internal emittance device has been built for the AGS, with separate units to measure the horizontal and vertical profiles of the circulating beam. Positive ions from collisions of the beam with background gas are collected in a 3-kV/cm electric field onto a 64-channel parallel strip detector. Because positive ions rather than electrons are collected, profile broadening due to space charge is small. Tests indicate that a quantitative, reproducible and accurate measurement of beam size throughout the acceleration cycle is provided.

6494 **Continuous tune measurements using the Schottky detector.** Linnecar, T.; Scandale, W. (European Org. for Nuclear Research (CERN), Geneva). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2185-2187(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A continuous measurement of the betatron tune has been implemented in the SPS pp^- collider with hardware normally used for the detection of Schottky noise. Suitable values for the tunes and chromaticities are thus more easily achieved in a machine where the strong space charge effects of the two counterrotating beams severely reduce the available space in the resonance diagram. The basic idea is to monitor the frequency of one of the betatron lines together with the revolution frequency and to deduce the tune according to a formula provided in this paper. The betatron lines which naturally appear as noise signals adding incoherently are strongly enhanced by exciting the beam at the required frequency with a kicker. The whole system then forms a closed loop in which an oscillator excites the beam producing a coherent signal at the Schottky detector, this signal providing the reference to lock the oscillator frequency. The excitation, 50 W at 10.7 MHz causes particle loss (about 3%/cycle) and emittance blow-up (about 10%/cycle) restricting the use of the apparatus to setting-up periods.

6495 **Further development of instrumentation for the Tevatron beam dump.** Harms, E.; Hendricks, B.; Williams, T.L. (Fermi Nat.'l Accelerator Lab., P.O. Box 500, Batavia, IL 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2196-2197(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Circuitry has been developed for remote monitoring of the Tevatron beam dump instrumentation package. This package includes an x-y beam position detector, calorimeters, and temperature sensing devices. Details of the electronics design as well as expected response to beam-on conditions are presented.

6496 **A new method for longitudinal emittance measurements.** Strehl, P. (GSI, Gesellschaft fur Schwerionenforschung mbH, D-6100 Darmstadt). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2198-2200(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A procedure for the measurement of beam parameters in the longitudinal phase space has been developed and tested at the Unilac. Approximating the particle distribution in the ΔW-, Δ/phi/-plane by ellipses the method will be practicable at all rf-accelerators if bunch width can be measured. Taking advantage of the broadband capacitive pick-up system of the Unilac two different algorithms can be used for the evaluation of the relevant ellipse parameters. One algorithm is based on the measurement of the bunch width at different positions along the accelerator as a function of the drift length. The other one uses an rf-resonator operated at + 90° or - 90° stable phase with different amplitudes to vary the energy spread and therefore the bunch width at one pick-up. The paper describes both methods and gives some examples from measurements at the Unilac.

6497 **An emittance scanner for intense low-energy ion beams.** Allison, P.W.; Holtkamp, D.B.; Sherman, J.D. (Los Alamos Nat.'l Lab., NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2204-2206(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

An emittance scanner has been developed for use with low-energy H- ion beams to satisfy the following requirements: angular resolution of + or - 1/2 mrad, small errors from beam space charge, and compact and simple design. The scanner consists of a 10-cm-long analyzer containing two slits and a pair of electric deflection plates driven by a + or - 500-V linear ramp generator. As the analyzer is mechanically driven across the beam, the front slit passes a thin ribbon of beam through the plates. The ion transit time is short compared with the ramp speed; therefore, the initial angle of the ions that pass through the rear slit is proportional to the instantaneous ramp voltage. The current through the rear slit then is proportional to the phase-space density $d^2i/dxdx'$. The data are computer-analyzed to give, for example, rms emittance and phase-space density contours. Comparison of measured data with those calculated from a prepared (collimated) phase space is in good agreement.

6498 **Beam dump/diagnostics assembly for a 10-kA, 50-MeV, 50-ns electron beam.** White, J.M.; Fessenden, T.J.; Fontaine, R.A.; Harvey, A.R.; Paul, A.C. (Lawrence Livermore Nat.'l Lab., P.O. Box 808, L-544 Livermore, CA 94550). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2207-2209(Aug 1983). (CONF-830311—). Contract W-7405-ENG-48.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The authors have developed a dump for the ATA beam that consists of a series of carbon plates whose collective thickness totals approximately 1.5 ranges at 50 MeV. The energy dissipated in the plates is radiated to a water cooled wall. The dump is designed to dissipate up to 175 kW of average power. A small hole along the axis of the plates forms a beamlet that passes through an energy analyzer. The analyzer consists of a 60° bending magnet and two high sensitivity beam current/position monitors. The ratio of the beamlet current to full current is used to estimate the beam emittance.

6499 **A high resolution wire scanner beam profile monitor with a microprocessor data acquisition system.** Cutler, R.I.; Mohr, D.L.; Whittaker, J.K.; Yoder, N.R. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2213-2215(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A beam profile monitor has been constructed for the NBS-LANL Racetrack Microtron. The monitor consists of two perpendicular 30 μm diameter carbon wires that are driven through an electron beam by a pneumatic actuator. A long-lifetime, electroformed nickel bellows is used for the linear-motion vacuum feedthrough. Secondary emission current from the wires and a signal from a transducer measuring the position of the wires are simultaneously digitized by a microprocessor to yield beam current density profiles in two dimensions. The wire scanner is designed for use with both pulsed and cw beams.

6500 **Cherenkov light as a current density diagnostic for large area, repetitively pulsed electron beams.** Buttram, M.; Hamil, R. (Sandia Nat.'l Labs, Albuquerque, NM 87185). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2216-2218(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Cherenkov light intensity is an ideal electron beam current density diagnostic, giving information about the beam's spatial distribution as a function of time during a pulse. It is free of the fluorescence and saturation often observed in scintillators provided a suitable radiator is chosen. Plate glass has been used for single pulse applications. For repetitively pulsed beams a flowing liquid radiator is used to reduce problems arising from heating and decomposition of the material. Light output is sufficient to study 1 A/cm², 250 kV beams with ASA 3000 speed film. Streak photography also appears possible.

6501 **Beam diagnostics for Hesyrl, the 800-MeV synchrotron radiation facility in Hefei.** Yin, Y. (University of Science and Technology of China, Hefei). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2231-2233(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The beam diagnostic system for the 800 MeV synchrotron radiation facility is described here. A new type of monitor, a stripline and gap combined monitor, for both position and current is presented.

6502 **Phase and amplitude detection system for the Stanford/linear accelerator.** Fox, J.D.; Schwarz, H.D. (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA 94305). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2264-2266(Aug 1983). (CONF-830311—). Contract AC03-76SF00515.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A computer controlled phase and amplitude detection system to measure and stabilize the RF power sources in the Stanford Linear Accelerator is described. This system measures the instantaneous phase and amplitude of a 1 microsecond 2856 MHz RF pulse and will be used for phase feedback control and for amplitude and phase jitter detection. This paper discusses the measurement system performance requirements for the operation of the Stanford Linear Collider, and the design and implementation of the phase and amplitude detection system. The fundamental software algorithms used in the measurement are described, as is the performance of the prototype phase and amplitude detector system.

6503 **High energy gamma ray beams from compton backscattered laser light.** Sandorfi, A.M.; Giordano, G.; LeVine, M.J.; Matone, G.; Schaerf, C.; Thorn, C.E. (Phys. Dept., Brookhaven Nat.'l Lab., Upton, NY 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3083-3087(Aug 1983). (CONF-830311—). Contract AC02-76CH00016.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Collisions of light photons with relativistic electrons have previously been used to produce polarized γ-ray beams with modest (about 10%) resolution but relatively low intensity. In contrast, the LEGS project (Laser+Electron Gamma Source) at Brookhaven will produce a very high flux ($> 2 \times 10^7\ s^{-1}$) of background-free polarized γ rays whose energy will be determined to a high accuracy ($\Delta E = 2.3$ MeV). Initially, 300(420) MeV γ rays will be produced by backscattering UV light from the new 2.5(3.0) GeV X-ray storage ring of the National Synchrotron Light Source (NSLS). The LEGS facility will operate as one of many passive users of the NSLS. In a later stage of the project, a Free Electron Laser is expected to extend the γ-ray energy up to 700 MeV.

6504 **Bunch-by-bunch intensity monitor for Fermilab main ring.** Pasquinelli, R.J. (Fermilab, P.O. Box 500, Batavia, IL 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2351-2352(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A bunch-by-bunch intensity monitor has been developed for the Fermilab Main Ring with future intended use in the Energy Doubler/Saver. The input signal is a beam doublet from a quarter wave stripline pickup that varies from 2 to 8 nanoseconds FWHM. The faithful integration of this pulse will produce an intensity signal proportional to the number of protons per bunch. The technique used is a fast integrate, hold, and damp. The intensity output is then made available for digitizing in the Snapshot Digitizer System. Beam losses at various points of the accelerating cycle may then be monitored on a bunch-by-bunch basis. The intensity monitor requires, in addition to the beam doublet, the input of a synchronized VCO. It is important that the group delay of both the VCO and beam input lines be identical so as not to change the phase relationship between the two as the RF is frequency modulated during acceleration. The doublet input dynamic range adjustment is a switched bank of coaxial attenuators. Their selection is based on predicted beam intensity for each accelerator cycle. A block diagram of the intensity monitor is provided.

6505 **Single bunch profile measurement using synchrotron light from an undulator.** Bosser, J.; Burnod, L.; Coisson, R.; D'Amico, E.; Ferioli, G.; Mann, J.; Meot, F. (European Org. for Nuclear Research (CERN), 11211 Geneva 23). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2164-2166(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

For protons with energies up to 400 GeV classical theory shows that the critical energy of the synchrotron radiation due to the constant field of the bending magnets is in the far infrared with a negligible part in the visible light spectrum. It was shown, however, that magnetic field discontinuity at the edges of the bending magnets shifts the spectrum to the visible region where normal light detectors can be used. This "edge effect" allowed the detection of visible synchrotron radiation emitted by high energy protons in the CERN Super Proton Synchrotron (SPS). The first application of this effect was to measure by a non-interceptive method the transverse proton density distribution for an energy above 270 GeV. For the use of the SPS as a pp^- collider at this energy it was necessary to enhance the synchrotron light with an undulator and to develop a more sensitive and gated detector to get p and p^- single bunch profiles. This paper describes the theory and operation of the periodic magnetic structure called the undulator and installed on the CERN SPS.

6506 **An RF device for precision location of the beam position detectors in the energy saver.** Kerns, Q.A.; Biallas, G.H.; Turkot, F.; Webber, R.C.; Wehmann, A. (Fermi Nat.'l Accelerator Lab., P.O. Box 500, Batavia, IL 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2250-2252(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The requirement that the Energy Saver operate in fixed-target mode with slow beam extraction and at high intensity implies that the location of the closed orbit in the accelerator be controlled with a precision of ca. 1 mm. Transverse beam position, either horizontal or vertical, is sensed by a pair of strip line pickups built into an 18" long piece of beam tube which is welded onto the upstream end (proton direction) of each superconducting quadrupole. The task is to measure the center line of the beam detector with respect to the magnetic centerline with a precision of + or - 0.2 mm. An RF device operating at 53 MHz was adopted for the following reasons: it provides complete electrical checkout of the hardware at operating frequency, it requires no mechanical contact with the strip lines, and the demands of production measurements and maintenance of calibration are better matched to the skills of an average

technician. In this paper the authors describe the conceptual design, the fabrication, and the performance of this device.

6507 **An array of 1- to 2- GHz electrodes for stochastic cooling.** Voelker, F.; Henderson, T.; Johnson, J. (Lawrence Berkeley Lab., Univ. of CA, Berkeley, CA 94720). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2262-2263(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

This paper describes an array of directional-coupler loop-pairs that are to be used as either pickup or kicker electrodes for the frequency range of 1 to 2 GHz. Each coupler pair is a lambda/4 long parallel-plane transmission line that is arranged to be flush with the upper and lower surfaces of a rectangular beam pipe. As pickups, the coupler pairs are used in arrays and are operated at 80 K for improving the signal-to-noise ratio. The loop output power is added in stripline combiner networks before being fed to a low noise preamplifier. When the couplers are used as kickers the combining network serves to split the power and distribute it uniformly to each electrode. The prototype array, whose mechanical features are both described and schematicized, is located in the center of a 15″ diameter experimental vacuum tank attached to a 2 MV electron Van de Graaff accelerator. The results of its performance testing in this configuration are presented.

6508 **NBS-LANL RTM injector installation.** Wilson, M.A.; Ayres, R.L.; Cutler, R.I.; Lindstrom, E.R.; Martin, E.R.; Mohr, D.L.; Penner, S.; Yoder, N.R.; Young, L.M. (Nat.'l Bureau of Standards, Washington, DC 23034). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 3021-3023(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The injector for the NBS-LANL CW racetrack microtron consists of a 100 KeV electron gun and beam transport line followed by a 5 MeV linac. The function of the gun and transport line, which have been installed at NBS, is to provide a chopped and bunched 100 KeV and up to 0.67 mA dc or pulsed beam of very low transverse emittance for matched insertion into the linac. In this paper the authors present both the design and construction details of the 100 KeV system and the results of preliminary beam tests. The tests conducted thus far show the gun and transport system to be performing well within design specifications.

6509 **The wire transport code.** Caporaso, G.J.; Cole, A.G. (Lawrence Livermore Nat.'l Lab., P.O. Box 808 L-321, Livermore, CA 94550). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2618-2620(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The wire transport code is a particle code that follows a single disc of the electron beam through the transport system. It was developed to study the dynamics of relativistic electron beam propagation in a transport tube in which a wire conditioning zone is present. In order for the beam to propagate successfully in the transport section it must be matched onto the wire by focusing elements. The beam must then be controlled by strong lenses as it exits the wire zone. The wire transport code was designed to model this process in substantial detail. It is able to treat axially symmetric problems as well as those in which the beam is transversely displaced from an axis of the transport tube. The focusing effects of foils and various beamline lenses are included in the calculations. After discussing briefly the physics of wire propagation this paper describes the structural and operational aspects of the code.

6510 **An electron beam buncher to operate over the frequency range 1-4 GHz.** Goldberg, D.A.; Arthur, A.A.; Flood, W.S.; Voelker, F. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA 94720). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 3657-3659(Aug 1983). (CONF-830311—). Contract AC03-76SF00098.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The authors present a description of an electron buncher to be installed in the terminal of a Van de Graaff, which is to produce a modulated beam over the frequency range 1-4 GHz. The modulator geometry has been optimized so that the modulation amplitude should be nearly constant over the frequency ranges 1-2 GHz and 2-4 GHz. Preliminary results indicate the device works as predicted.

6511 **Design of a versatile ESQ transport system.** Brodowski, J. (Accelerator Dept., Brookhaven Nat.'l Lab., Assoc. Univ.'s Inc., Upton, NY 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 3666-3668(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A versatile precision beam transport channel was built with inexpensive parts requiring minimum precision machining. The critical items, an optical bench and sliding bases are commercially available standard items. The only important precision machining is a small section of an optical bench used as a quadrupole assembly holding fixture. With this type of fixturing there is no loss of precision during the transfer of the quadrupole assembly from the EDM setup onto the final assembly, other than the manufacturer-specified mounting and dismounting tolerance. Displacement measurements of the pole tips taken on ten different quadrupole assemblies determined that RMS displacement in the "x" direction was .000307" and in the "y" direction was .000290".

6512 **The application of magnetic switches as pulse sources for induction linacs.** Birx, D.; Cook, E.; Hawkins, S.; Poor, S.; Reginato, L.; Schmidt, J.; Smith, M. (Lawrence Livermore National Laboratory, Post Office Box 808/L-321, Livermore, California 94550). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2763-2768(Aug 1983). (CONF-830311—). Contract W-7405-ENG-48.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Future accelerator requirements of the Particle Beam Program for increased repetition rates and reliability led to the investigation of alternative switching schemes of pulse compression using saturable inductors. This technique has been in use for several decades, but at relatively low power levels and long pulses. Recent developments in amorphous magnetic materials has eased the challenging problem of generating 250 kV pulses for 50 ns at power levels exceeding 20 GW with fast risetime and good efficiency. The timing simultaneity required in linacs from many such parallel systems was achieved with a high degree of voltage regulation and timing feed-forward techniques. The application of magnetic switching has not only exceeded the rep-rate and jitter requirements for short bursts of pulses, but has provided excellent reliability making them applicable for a variety of other high-average power applications besides the Particle Beam Program.

6513 **Regulator to control current sharing among parallel-connected power transistors.** Wells, F.D.; Higgins, E.F.; Mauro, M.E. (AT-3, MS H808, Los Alamos Nat.'l Lab., Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2935-2937(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A current regulator is described that controls the peak current of a power transistor driving an inductive load, such as magnet coils. Presently, the current pulse has a 0.1- to 1-ms adjustable duration with duty cycle to 5%. Ultimately, the pulse length must be ∫ ms with 50% duty cycle. The peak current nominally is 200 A, as set by a reference pulse. Several transistors, each controlled by an individual regulator, are connected in parallel to provide the total peak load current. The regulators compensate for differences between the power transistors and assure equal current sharing among the collectors. The regulator comprises an 8-bit multiplying digitalto-analog (D/A) converter that drives the base of the power

transistor, an 8-bit up-down counter, an analog differencing circuit, and a comparator. For control purposes, a current-sensing resistor in the transistor's collector produces the second input to the differencing circuit. Regulation is accomplished over a collector current range of 200 + or - 50 A per stage.

6514 **A nanosecond pulsed electron gun system for BEPC.** Meng-Ping, G.; Guo-Hui, Z.; Jian-Lin, M.; Zhu-Ming, Q. (Inst. of High Energy Physics, Academia Sinica, Beijing). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2962-2964(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A nanosecond pulsed electron gun has been installed at IHEP in Beijing. Two types of pulser have been tested for the fast pulsed gun. Instead of the hybrid fast pulser, a new transistor avalanche pulser was developed. 1.1 Amp beam pulse current from the gun has already been obtained. Preliminary test and details of the gun system are presented in this paper.

6515 **Design and fabrication of the BNL radio frequency quadrupole.** Mckenzie-Wilson, R.B. (Accelerator Dept., Brookhaven Nat.'l Lab., Assoc. Univ.'s Inc., Upton, NY 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2998-3000(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The Brookhaven National Laboratory polarized H^- injection program for the AGS will utilize a Radio Frequency Quadrupole for acceleration between the polarized source and the Alvarez Linac. Although operation will commence with a few μ amperes of H^- current, it is anticipated that future polarized H^- sources will have a considerably improved output. The RFQ will operate at 201.25 MHz and will be capable of handling a beam current of 0.02 amperes with a duty cycle of 0.25%. The resulting low average power has allowed novel solutions to the problems of vane alignment, rf current contacts, and removal of heat from the vanes. The cavity design philosophy is discussed together with the thermodynamics of heat removal from the vane. Details of the fabrication are presented with a status report.

6516 **An injector for RFQ1.** Shubaly, M.R.; de Jong, M.S. (Atomic Energy of Canada Limited, Research Company, Chalk River Nuclear Laboratories, Chalk River, Ontario KOJ 1JO). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3001-3003(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

RFQ1 has been designed as a 600 keV, 75 mA cw radiofrequency quadrupole (RFQ) accelerator with a 50 kV injector that will be used to study the operation and current limits of an RFQ structure. Its injector must operate over a wide current range at a fixed energy and must match the acceptance of the RFQ structure over the entire range. This paper discusses the requirements and the final design of the injector. Experiments performed on existing test facilities to study some aspects of the design are also presented.

6517 **Mechanical design of a heavy ion RFQ.** Abbott, S.; MacGill, R.; Yourd, R. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA 94720). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3004-3006(Aug 1983). (CONF-830311—). Contract AC03-76SF00098.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The mechanical design and construction of a 199.3 MHz heavy ion RFQ for charge states q/A as low as 0.14 is described. The vane supports and positioning adjustments are significant features of this design. They provide the capability of achieving the precision vane alignment required. The maximum difference between calculated and measured apertures between the vanes is 0.0035 inches, and the average difference is 0.0010 inches. Various important aspects of the design and construction including material selection and plating, RF joints, thermal loading and vacuum system are described. Assembly techniques, methods of mechanical measurement, alignment and structure stability are discussed in detail.

6518 **The CERN SPS low beta insertion control system.** Kuhn, H.K.; Hilaire, A. (CERN, 1211 Geneva 23). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2293-2295(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Within the context of the CERN SPS ppbar colliding beam experiments there are 2 X 15 power supplies which have to provide the currents necessary to produce the two low-beta insertions. Their control system is described for both the hardware and the software parts. The references use a combination of an 18 bit DAC and an integrator to produce a relatively smooth drive signal to the current controlled power supplies. These 18 bit devices must operate in a hostile environment (electrical noises, temperature changes). Results are given on their performances, especially on the accuracy achieved at the required settings (better than 10^{-4} at intermediate levels) and, more important, the repeatability (of the order of 10^{-5}). Each set of 15 references is controlled from a dedicated computer. Each 60 msec point of each reference can be defined for a cycle length of up to 21.6 sec. The software driver is laid out such that during the pulsing mode (setting up) one can insert minicoasts at any desired level or, during the coast proper at 270 GeV, one can adjust simultaneously the level of 1, some or all 30 references. The system also allows the setting up of a high beta in one insertion and a low beta in the other. It has transposed the theoretically calculated values so well that all the desired beta characteristics were achieved without having to add corrections due to inaccuracies in the reference control system.

6519 **The use of a commercial data base management system in the LAMPF control system.** Brown, S.K. (Los Alamos National Laboratory, Box 1663, MS-H810, Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2302-2304(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The control system for the accelerator at the Los Alamos Meson Physics Facility (LAMPF) is currently being upgraded to run on a DEC VAX 11/780. To unify the several disparate control hardware protocols into one consistent software protocol requires that the hardware devices be addressed logically rather than physically, the physical connections being supplied by the control system. To accomplish this, the control system must have some link between the devices' logical names and their physical connections. This link is supplied by a data base which is managed by a commercial data base management system. This paper discusses the reasoning behind the choice of a commercial system, the particular DBMS chosen and some of the pros and cons of using the DBMS as well as some experience in trying to join tools of the commercial world with the real-time world.

6520 **Data acquisition software for the LAMPF control system.** Schaller, S.C.; Rose, P.A. (Los Alamos Nat.'l Lab., Box 1663, MS-H810, Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2308-2310(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

As part of the upgrade of the Los Alamos Meson Physics Facility (LAMPF) control computer, the software providing the interface between application programs and the accelerator hardware was redesigned. This new Data System design - which handles more than 12,000 widely different devices - allows greater uniformity, flexibility, maintainability, and hardware independence than before. The Data System portion of the LAMPF Control System is described in this paper.

6521 **On-line control models for the Stanford linear collider.** Sheppard, J.C.; Helm, R.H.; Lee, M.J.; Woodley, M.D. (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA 94305). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2320-2322(Aug 1983). (CONF-830311—). Contract AC03-76SF00515.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Models for computer control of the SLAC three-kilometer linear accelerator and damping rings have been developed as part of the control system for the Stanford Linear Collider. Some of these models have been tested experimentally and implemented in the control program for routine linac operations. This paper describes the development and implementation of these models, as well as some of the operational results.

6522 **A new control system for the SLAC accelerator klystrons for SLC.** Jobe, R.K. (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA 94305). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2325-2327(Aug 1983). (CONF-830311—). Contract AC03-76SF00515.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A general overview of a new control system for SLAC klystrons is presented along with a detailed description of the remote controller for measurement and control of accelerator components.

6523 **Applications of FASTBUS to beam diagnostics and experiment data systems.** Machen, D.R. (Scientific Systems Int.'l, Los Alamos, NM 87544). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2328-2330(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A five-year effort by the North American NIM Committee, in collaboration with the ESONE Committee of European Laboratories, has resulted in a specification for the FASTBUS modular high-speed data-acquisition system. The system is designed around an emitter-coupled logic (ECL) 32-bit data bus for asynchronous data transmission at 100 ns per transaction. Initial applications of FASTBUS will be in experiment data systems at accelerator facilities worldwide--beam diagnostic data systems on the accelerator side and particle-beam experiment data systems in the experimental area. As the specification (and the resulting hardware and software) matures, real-time machine-control applications will become possible. This paper discusses the near-term use of FASTBUS in accelerator beam-diagnostics instrumentation systems, where an extra increment in system throughput and front-end processing speed can produce a greater understanding of the physical phenomena under study. The arguments and conclusions may be equally well applied to other similar data-handling problems requiring high bandwidth in the data system.

6524 **An interactive alarm system for the CERN PS accelerator complex.** Cuperus, J. (CERN, CH-1211 Geneva 23). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2337-2339(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The new CPS control system started operation in 1980 and is gradually being extended to control several accelerators and beam lines of the CPS complex. Part of the system and growing with it is a data-base driven alarm system. In each front-end computer, a program monitors the equipment, another the CAMAC interface and a third the beam currents. These programs send data to a central computer. In general-purpose consoles, a screen and touch-panel are dedicated to the alarm system. The alarms are displayed in various formats and levels of detail according to the wishes of the operator, who can also attempt automatic reset of individual faults or groups of related faults. Except for beam current monitoring, no details about the equipment are coded in the programs. The list of the equipment to be checked and information about it are stored in an off-line data base from which the necessary real-time files can be derived automatically. The result is a powerful and unified alarm system which can be easily maintained and updated.

6525 **Application of local area networks to accelerator control systems at the Stanford linear accelerator.** Fox, J.D.; Linstadt, E.; Melen, R. (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA 94305). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2317-2319(Aug 1983). (CONF-830311—). Contract AC03-76SF00515.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The history and current status of SLAC's SDLC networks for distributed accelerator control systems are discussed. These local area networks have been used for instrumentation and control of the linear accelerator. Network topologies, protocols, physical links, and logical interconnections are discussed for specific applications in distributed data acquisition and control systems, computer networks and accelerator operations.

6526 **Performance of the NBS-LANL RTM injection line vacuum system.** Cutler, R.I. (Nat.'l Bureau of Standards, Washington, DC 20234). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2904-2905(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A 1000 l/sec cryopump is used to provide the hydrocarbon-free vacuum required for the 100 keV electron beam transport line of the NBS-LANL Racetrack Microtron. The beam line is 3.5 cm in diameter and 4 m long. To overcome the low vacuum conductance of the beam line, it is pumped every 1/2 meter by a 15 cm diameter vacuum manifold which is connected to the cryopump. A single cryopump is used rather than several ion pumps to reduce costs and to provide easier starting. An oil-free roughing pump and sorption pump are used in the initial pumpdown. The vacuum system is all metal sealed. Vacuums of 3×10^{-6} Pa are reached in 8 hours from atmospheric pressure without baking out the system, and ultimate vacuums of 5×10^{-7} Pa are achieved.

6527 **Cryogenic system for a superconducting spectrometer.** Porter, J. (Lawrence Berkeley Lab., Univ. of Cal., Berkeley, CA 94720). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2909-2910(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The Heavy Ion Spectrometer System (HISS) relies upon superconducting coils of cryostable, pool boiling design to provide a maximum particle bending field of 3 tesla. This paper describes the cryogenic facility including helium refrigeration, gas management, liquid nitrogen system, and the overall control strategy. The system normally operates with a 4K heat load of 150 watts; the LN_2 circuits absorb an additional 4000 watts. 80K intercept control is by an LSI 11 computer. Total available refrigeration at 4K is 400 watts using reciprocating expanders at the 20K and 4K level. The minicomputer has the capability of optimizing overall utility input cost by varying operating points. A hybrid of pneumatic, analog, and digital control is successful in providing full time unattended operation. The 7m diameter magnet/cryostat assembly is rotatable through 180 degrees to provide a variety of spectrometer orientations.

6528 **Magnet coil system for a superconducting spectrometer (HISS).** Reimers, R.M.; Wolgast, R.C.; Yamamoto, R.M. (Lawrence Berkeley Lab., Univ. of Cal., Berkeley, CA 94720). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2911-2913(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The Heavy Ion Superconducting Spectrometer (HISS) facility and coils are briefly described while most of the paper discusses the support structures consisting of flanged doubly tapered stainless steel cylinders having a Z-shaped cross-section with average diameter of approximately 2.35 meters and height of approx. .49 meters.

This member serves as a one piece coil support to resist gravitational, seismic, and magnetic forces with an approximate heat leak to helium of 59 watts per cylinder during operation of magnet at 4 degrees K. Maximum magnetic forces on each coil are over 11 meganewtons at 3T excitation. Magnetic forces attracting the coils to the core vary with excitation in direction as well as in magnitude. Radial magnetic forces produce stresses internal to the coil bobbin.

6529 **Spark-gap crowbar for high-voltage power supply.** Mitra, A.K.; Tallerico, P.J. (AT-5 MS H827, Los Alamos Nat.'l Lab., Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2862-2864(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A new crowbar circuit employing a pressurized spark gap has been designed to replace the existing ignitron crowbar that protects a 500-kW klystron tube when it arcs. The spark gap offers definite performance advantages when compared to the conventional ignitron circuits. The small overall size makes the spark gap more convenient and the very few components make it more reliable than the ignitron crowbar.

6530 **Application of a digital trigger generator to NSLS booster and storage ring dipole power supplies.** Culwick, B.B.; Olsen, R.E. (Nat.'l Synchrotron Light Source, Brookhaven Nat.'l Lab., Upton, NY 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2865-2866(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The digital trigger generator has been used to control a number of power supplies at the NSLS. Two extensions to the basic controller have been used to preserve its inherent high performance in particular applications. In the case of fast slew rate applications, the bandwidth limits of the supply generate errors in tracking the current reference. The repetitive nature of the NSLS Booster cycle has made possible an adaptive feed-forward scheme which corrects the errors of a given cycle based on data derived from previous cycles. For slowly varying current regulated supplies, the residual subharmonic ripple due to unbalanced phase voltages, transformer unbalance, etc. is corrected by means of a microprocessor based harmonic analyser which feeds data to the phase correction input of the controller.

6531 **A high performance digital triggering system for phase controlled rectifiers.** Olsen, R.E. (Nat.'l Synchrotron Light Source, Brookhaven Nat.'l Lab., Upton, NY 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2867-2869(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The larger power supplies used to power accelerator magnets are most commonly polyphase rectifiers using phase control. While this method is capable of handling impressive amounts of power, it suffers from sub-harmonic ripple. Since the stability of the stored beam depends to a considerable extent on the regulation of the current in the bending magnets, sub-harmonic ripple, especially that of low frequency, can have a detrimental effect. At the NSLS, a 12 pulse, phase control system using digital signal processing techniques has been constructed that essentially eliminates sub-harmonic ripple.

6532 **A broadband accelerator control network.** Skelly, J.; Clifford, T.; Frankel, R. (Brookhaven Nat.'l Lab., Upton, NY 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2155-2157(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A broadband data communications network has been implemented at BNL for control of the Alternating Gradient Synchrotron (AGS) proton accelerator, using commercial CATV hardware, dual coaxial cables as the communications medium, and spanning 2.0 km. A 4 MHz bandwidth Digital Control Channel using CSMA-CA protocol is provided for digital data transmission, with 8 access nodes available over the length of the RELWAY. Each node consists of an rf modem and a microprocessor-based store-and-forward message handler which interfaces the RELWAY to a branch line implemented in GPIB. A gateway to the RELWAY control channel for the (preexisting) AGS Computerized Accelerator Operating System has been constructed using an LSI-11/23 microprocessor as a device in a GPIB branch line. A multilayer communications protocol has been defined for the Digital Control Channel, based on the ISO Open Systems Interconnect layered model, and a RELWAY Device Language defined as the required universal language for device control on this channel.

6533 **Monitor 1983.** Grisham, D.L.; Lambert, J.E. (Los Alamos Nat.'l Lab., Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2267-2269(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The Monitor remote handling system was especially developed to perform "in situ" remote maintenance operations on Line A at the Clinton P. Anderson Meson Facility (LAMPF). The "Monitor I" and "Monitor II" systems have served well in performing all necessary maintenance; however, future major improvements and expansion of experimental facilities call for development of a third system. Monitor III is a more portable system which will be able to support major disassembly and reconstruction of facilities remote from Line A. The system will include a large trailer mounted cask for safe transport of obsolete radioactive beam line components to the disposal site.

6534 **Wide-band cable systems at SLAC.** Struven, W. (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA 94305). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2323-2324(Aug 1983). (CONF-830311—). Contract AC03-76SF00515.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

SLAC's first cable TV system was installed in 1979 to remotely monitor a narrow pulse generated in the west end of the klystron gallery. When Stanford Linear Collider (SLC) experimental work began at the west end of the accelerator this cable was upgraded to a bidirectional system. The present accelerator control system is based on a distributed processing configuration using a PDP11/780 VAX in the Main Control Center and Intel single-board computers in a multibus configuration along the accelerator. The high-speed data linking is supplied by a 1 MBaud Time Division Multiple Access Network. A midsplit configuration was chosen for the cable because it provides roughly equal spectra above and below the filter split. The cable will offer the following services when it is completely utilized: four 6 MHz video channels (camera or computer signals); forty channels of voice (CB sets for intercoms); two 6 MHz 1 MBaud channels (monitoring and control of the accelerator); one 6 MHz of Sytek System 20 9600 baud channels (terminal to VAX); and six 6 MHz point-to-point 2 MBaud channels (pattern and fast feedback loops). These subsystems and their interfaces are described and schematicized.

6535 **Long ceramic beam tubes for accelerator magnets.** Tilles, E.B.; Adderley, P.A.; Biallas, G.H.; Harrison, M.A.; May, M.P. (Fermi Nat.'l Accelerator Lab., P.O. Box 500, Batavia, IL 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2847-2849(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The ceramic beam tubes for the fast and abort kickers and the bucker and pinger magnets used at Fermilab must meet a number of exacting requirements. The tubes must be long and sufficiently straight so as not to limit magnet design. They must have wall strength capable of withstanding the atmospheric and mechanical forces encountered during construction and operation. Vacuum tight ceramic to stainless steel transitions must be of rea-

sonable cost; they must also withstand high temperature processing and remain vacuum tight to the 10^{-9} Torr range. To remove the possibility of static charge buildup each tube must have a surface coating of indium oxide applied to the inner wall. This thin coating is difficult to achieve and requires the most careful attention to detail. The methods used at Fermilab to achieve these goals are presented in this paper.

6536 **Operation of the Tevatron satellite refrigerators for .75- and 2.0-kilometer-long magnet strings.** Rode, C.H.; Andrews, R.A.; Ferry, R.; Gannon, J.; Makara, J.; Martin, M.; Misek, J.; Peterson, T.; Theilacker, J. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2892-2894(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The Tevatron magnets at Fermilab are cooled by a hybrid system which consists of a 5000 liters/hr central helium liquefier coupled with a small-diameter liquid transfer line connecting twenty-four satellite refrigerators. The transfer line supplies liquid helium for both the refrigerators and the magnet lead flow as well as liquid nitrogen for the magnet shields. The satellites act as amplifiers with a gain of twelve by using the enthalpy of the helium supplied by the central liquefier as liquid and converting it to 4.5-K refrigeration and then returning it as 300-K gas. This arrangement combines the advantages of a single central facility with those of individual stand-alone units stationed around the ring. The central liquefier has the high efficiency associated with large components but its requirements for distribution of both cryogenic liquids and electric power to the service buildings is reduced. The six compressor buildings supply 20 atm helium to the twenty-four refrigerators through a discharge header located on the berm and a suction header located in the tunnel. The compressor buildings each have four-two stage 58 g/sec screw compressors; each of these has its own oil removal system. The inventory in the ring is controlled at the first compressor building through a cross-connect line to the central liquefier. The suction header is also used as the cooldown line as well as for quench relief. A third header located in the tunnel is the nitrogen collection and relief header.

6537 **The Ganil vacuum system - results.** Rommel, G. (Ganil BP 5027 14021 CAEN Cedex, Tel. (31)94 81 11 Telex 170533 F). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2914(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The GANIL heavy ion accelerator located in France consists mainly of two large separated sector cyclotrons. This paper discusses the vacuum characteristics, design and operation of the first of these cyclotrons, which has been on line since June 1982. The vacuum chamber is described as monolithic. It is made of stainless steel, mild steel, copper, elastomer, and plastic materials; the total surface area which each of these materials occupies inside the chamber is given. Eight cryogenic pumps provide the pressure decrease necessary for the conservation of 80% of the uranium beam. The pumping process required to obtain this vacuum is detailed and two variations are compared. The results of testing these processes and investigating the relationships between RF voltage and beam intensity and pressure decrease were found by the author to be curious. The partial pressure of water vapor decreased while that of hydrogen remained stable and even increased. There seemed to be an infinite source of hydrogen inside the vacuum which the author concludes was probably desorbed from the 200 tons of mild steel in the pole pieces. Another conclusion was that the cryopumps, stopped every 48 hours in order to regenerate, desorbed hydrogen during their down time, and that this desorbed gas should be removed by the implementation of turbomolecular pumps. Whether these pumps can handle the volume of hydrogen and water vapor and whether they might be sources themselves of these pollutants remains speculative. Experimentally, it was found that hydrogen is less dangerous to the beam than nitrogen, oxygen, or water vapor. Pressure criteria for the GANIL accelerator are given.

6538 **Maximum field capability of energy saver superconducting magnets.** Turkot, F.; Cooper, W.E.; Hanft, R.; McInturff, A. (Fermi Nat.'l Accelerator Lab., Batavia, IL 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3387-3389(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

At an energy of 1 TeV the superconducting cable in the Energy Saver dipole magnets will be operating at ca. 96% of its nominal short sample limit; the corresponding number in the quadrupole magnets will be 81%. All magnets for the Saver are individually tested for maximum current capability under two modes of operation; some 900 dipoles and 275 quadrupoles have now been measured. The dipole winding is composed of four individually wound coils which in general come from four different reels of cable. As part of the magnet fabrication quality control a short piece of cable from both ends of each reel has its critical current measured at 5T and 4.3K. In this paper the authors describe and present the statistical results of the maximum field tests (including quench and cycle) on Saver dipole and quadrupole magnets and explore the correlation of these tests with cable critical current.

6539 **Operation of the Tevatron six-kilometerlong transfer line.** Rode, C.H.; Ferry, R.; Lincicome, T.; Makara, J.; Theilacker, J.; Walker, R. (Fermi Nat.'l Accelerator Lab., P.O. Box 500, Batavia, IL 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2769-2771(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The Tevatron transfer line consists of twenty-six 250-meter sections interconnected with vacuum jacketed U-tubes forming a loop. Each section carries a supercritical helium line and a subcooled liquid nitrogen shield with an expansion joint in the middle of the run. The Tevatron refrigeration system is based on the concept of a Central Helium Liquefier providing liquid to twentyfour satellite refrigerators operating as amplifiers with a flow gain of 12 and providing 966 watts per unit. Both from the standpoint of system reliability and ease of installation, debug and startup, it was decided to build a complete transfer line loop starting at the Central Liquefier and returning to it. This loop consists of twenty-six independent sections; each is interconnected to the next by a pair of vacuum jacketed U-tubes with a branch tap to the local refrigerator. This system permits the loss of any one section and still maintains all twenty-four refrigerators operating by feeding a portion of the loop in reverse. This report describes the cross section of the transfer line, the expansion and bayonet cans at each end, and the U-tubes which connect the various sections and provide branch taps to the refrigerator and magnet systems, as well as other minor components of the cooling system. Specifications, materials, and schematics are provided.

6540 **Buncher for a microwave linear electron accelerator.** Westbrook, E.P.; Kyhl, R.L. (Naval Research Lab., Condensed Matter and Radiation Sciences Div., Code 6604 Washington, DC 20375). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3505-3507(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

This paper reports on design and construction features of a bunching system built at the Naval Research Laboratory (NRL) for the NRL linac, with emphasis on solution of the impedance matching and tuning problems inherent in the buncher design.

6541 **Additions and improvements to the RF cavity code SUPERFISH.** Schriber, S.O.; Holsinger, R.F. (Atomic Energy of Canada Ltd., Research Co., Chalk River Nuclear Lab.'s, Chalk River, Ontario KOJ 1JO). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3545-3547(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

SUPERFISH is a computer code that is used extensively to determine rf properties of rf structures. This paper describes a new post processor for SUPERFISH that determines temperature distributions in the metal enabling high average power rf characteristics for various cooling configurations to be examined. Different materials can be incorporated for different parts of the cavity geometry. Sample results for geometries including drift tube linacs and coupled cavity linacs are presented. Other improvements to the code give electric fields at all vacuum mesh points, normalized RFQ geometry parameters, and transit time factors associated with off-axis electric fields for MAPRO beam dynamics codes.

6542 **A highly efficient interdigital -H- type resonator for molecular ions.** Weis, T.; Klein, H.; Schempp, A. (Institut fur Angewandte Physik, Universitat Frankfurt/Main D-6000 Frankfurt/Main). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3548-3550(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

For accelerating molecular ions with low charge to mass ratio highly efficient resonators are needed to keep the accelerator length short and to decrease power consumption. Therefore the authors used a modified interdigital-H-type structure (TE_{111} excitation) to build a high power prototype for CO^+ molecules. They measured a surprisingly high bare shuntimpedance of 700 MΩ/m at 108.5 MHz. By using a proper design of drift tubes and stabilizing rods to fix the support stems, they also obtained a nearly constant axial field distribution. The resonator will be used for postacceleration of CO^+ molecules - which are preaccelerated to 153 keV/N by a CN Van de Graaff - up to 224 keV/N requiring less than 15 kW RF power, corresponding to a total cavity voltage of 3 MV and a resonator length of about 1 m.

6543 **Study of peak power doublers with spherical resonators.** Fiebig, A.; Hohbach, R. (CERN, 1211 Geneva 23). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3563-3565(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Based on the work done at SLAC by Z.D. Farkas et al. SLED, it was investigated whether a similar arrangement can be used for the LEP Injector Linac (LIL) in order to save high power klystrons by feeding, for a part of the accelerator, twice the number of accelerating sections from one klystron (LIPS = LEP Injector Power Saver). It seemed interesting to make use of the high quality factor of spherical resonators ($2...2.5 \times 10^5$) as compared to 10^5 of the cylindrical resonators used for SLED. The advantages (high Q) and disadvantages of spherical resonators (high number of competing resonant modes, problems of orientation, coupling) are discussed. Results of measurements with low power (c.w. and pulses) on single resonators and a complete model, and with high power on a prototype, are presented.

6544 **Development of disk-and-washer cavity in KEK.** Inagaki, S.; Ezura, E.; Furiya, T.; Higo, T.; Kitogawa, K.; Kojima, Y.; Nakanishi, H.; Noguchi, S.; Takata, K.; Tokashima, T. (Nat.'l Lab. for High Energy Physics, Oho-machi, Tsukuba-gun, Ibaraki-ken 305). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3572-3574(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The behavior of the deflecting mode of the disk and washer structure was studied experimentally and computationally. A possibility was proved that the second HEM_1 passband can be moved above the accelerating frequency and that the value of R/Q can be increased by 60 % compared to that of the shunt impedance optimized DAW cavity, if one makes a compromise with 80 % of the optimized shunt impedance. The transverse coupling impedance of the second HEM_1 mode at π phase shift is less than 1 Mohm/m for a single cell, which is small by more than an order of magnitude compared to that of the re-entrant cavity or disk loaded cavity.

4304 Storage Rings

REFER ALSO TO CITATION(S) 6413, 6432, 6471, 6817

6545 **(CAPE—2922) SLAC mechanical and electrical PAD nitrogen piping layout (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). 2 Dec 1983. Contract AC03-76SF00515. TIC, PO Bx 62, Oak Ridge, TN 37831.

Portions are illegible in microfiche products 35-mm aperture card.

The layout drawing (ID 309-400-05-R1 Installation Drawing) provides the connection and routing details for the mechanical and electrical utilities pad for regions 2, 4, 6, 8, and 12. This is a typical piping layout drawing showing the nitrogen lines running between various transformers, surge tanks, and other devices. These pads are located around the SLAC PEP storage ring. Subdrawings are not included.

6546 (DOE/ER/40058—1, pp 238-272) **Physics technology - cost of the new facilities - a world-wide round-up.** Turchinetz, W. (Massachusetts Inst. of Tech., Cambridge). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

An account of the status of 18 of the electron accelerator projects around the world is presented. The survey is restricted to those projects which are aimed mainly at studies of nuclear physics and which aspire to the development of CW beams.

6547 (DOE/ER/40058—1, pp 366-386) **Synchrotron radiation: a possible general purpose ring application.** Deslattes, R.D. (National Bureau of Standards, Washington, DC). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

Use of an accelerator which is primarily dedicated to electromagnetic nuclear physics for synchrotron radiation experiments is discussed. Synchrotron facilities worldwide and current and planned uses are reviewed. The special characteristics of continuous duty cycle electron accelerators as synchrotron radiation sources are described. (KAW)

6548 (DOE/ER/40058—1, pp 542-547) **Experiments using an electron storage ring - stretcher.** Booth, E. (Boston Univ., MA). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

This talk is concerned with electromagnetic experiments using an electron storage ring (stretcher) with thin internal targets or radiators. Although the count rate estimates are made for low energy (200 to 750 MeV) the concepts apply to experiments in the 2 to 4 GeV region. We assume that gas jet targets will be used. Attractive features of experiments with thin internal targets include: (a) high duty factor (> 50%), (b) resonable attainable luminosity, (c) no target melting, (d) low energy loss of electrons and reaction products in the target, (e) the possibility of polarized targets and beams, and (f) easy adaptation to parasite operation.

6549 **Infrared synchrotron radiation from electron storage rings.** Duncan, W.D.; Williams, G.P. (Royal Observatory, Blackford Hill, Edinburgh, UK). *Applied Optics;* **22**: No. 18, 2914-2923(15 Sep 1983). Contract AC02-76CH00016.

Simple and useful approximations, valid at infrared wavelengths, to the equations for synchrotron radiation are presented and used to quantify the brightness and power advantage of current synchrotron radiation light sources over conventional infrared broadband laboratory sources. The Daresbury Synchrotron Radiation Source (SRS) and the Brookhaven National Synchrotron Light Source (vacuum ultraviolet) [NSLS(VUV)] storage rings are used as examples in the calculation of the properties of infrared synchrotron radiation. The pulsed nature of the emission is also discussed, and potential areas of application for the brightness, power,

and time structure advantages are presented. The use of infrared free electron lasers and undulators on the next generation of storage ring light sources is briefly considered.

6550 **Computer simulation studies of single beam stability.** Siemann, R.H. (Lab. of Nuclear Studies, Cornell Univ., Ithaca, NY 14853). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2373-2377(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Single beam stability in large e^+e^- storage rings has been studied by computer simulation techniques. The inputs to the study are single particle equations of motion (including wakefield effects) and longitudinal and transverse wakefields. These wakefields are obtained by numerical integration of Maxwell's equations in the time domain. Qualitative and quantitative comparisons are made between the results of the simulation and data from PEP and PETRA, and the agreement is reasonable. Since the only numerical data needed for the simulation are lattice parameters and RF structure dimensions, it is now possible to predict beam stability in future accelerators.

6551 **Helium refrigeration system for BNL colliding beam accelerator.** Brown, D.P.; Farah, Y.; Gibbs, R.J.; Schlafke, A.P.; Schneider, W.J.; Sondericker, J.H.; Wu, K.C. (Brookhaven Nat.'l Lab., Upton, NY). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2901-2903(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A Helium Refrigeration System which will supply the cooling required for the Colliding Beam Accelerator at Brookhaven National Laboratory is under construction. Testing of the compressor system is scheduled for late 1983 and will be followed by refrigerator acceptance tests in 1984. The refrigerator has a design capacity of 24.8 kW at a temperature level near 4K while simultaneously producing 55 kW for heat shield loads at 55K. When completed, the helium refrigerator will be the world's largest. Twenty-five oil-injected screw compressors with an installed total of 23,250 horsepower will supply the gas required. One of the unique features of the cycle is the application of three centrifugal compressors used at liquid helium temperature to produce the low temperatures (2.5K) and high flow rates (4154 g/s) required for this service.

6552 **Computer control of RF-manipulations in the CERN antiproton accumulator.** Johnson, R.; van der Meer, S.; Pedersen, F.; Shering, G. (CERN, 1211 Geneva 23). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2290-2292(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The CERN antiproton accumulator uses a conventional RF system for bunched beam manipulation within the ring. Several different manipulations are needed, often in close succession, so a fast, reliable and accurate method of switching between them is required. This has led to an unconventional computerized beam control system. For a desired set of beam manipulations, the computer calculates the needed voltage and frequency as functions of time, using a mathematical model of the beam and lattice. These are then loaded into function generators which subsequently operate independently of the computer. The RF system, a dual gap, ferrite loaded cavity driven by a 4CX25000 power tetrode, has three main uses: the stacking process to accumulate the antiprotons, the unstacking process to make the accumulated antiprotons available for extraction, and a variety of test and measurement purposes. Two digital function generators control voltage and frequency in the cavity. The voltage function is logarithmic and is fed into an AVC loop which contains a logarithmic detector and modulator to provide high voltage for stacking and low voltage for unstacking. The frequency function controls a 10 to 30 kHz quadrature VCO which is mixed with the output of a quadrature synthesizer producing an 1840 to 1860 kHz frequency range. RF phase and magnet noise were harmful while manipulating low emittance proton and antiproton bunches. A high-pass phase loop acquires beam cavity phase; adding AC corrections to the frequency program eliminated this problem. The cavity tune is maintained by a tuning loop acting on a DC ferrite base. Schematics are provided.

6553 **Brookhaven free electron laser experiment.** Krinsky, S.; Luccio, A.; Pellegrini, C.; Steenbergen, A. van; Yu, L.H. (Brookhaven National Laboratory, Upton, NY (USA)). *Journal de Physique (Paris), Colloque;* 113-114(1983). (CONF-820988—).

From Free electron laser conference; Bendor, France (26 Sep 1982).

The status of the free electron laser experiment at Brookhaven is reported, with the description of the permanent undulator already built and ready to be installed on the VUV storage ring.

44 INSTRUMENTATION

REFER ALSO TO CITATION(S) 7062

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 6462, 6527, 6528, 6754, 6780, 6781, 6808

6554 **(EGG-PBS—6441) Calibration of fission product detection systems by means of Monte Carlo gamma ray transport.** Grimesey, R.A.; Wheeler, F.J. (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1983. Contract AC07-76ID01570. 19p. NTIS, PC A02/MF A01. Order Number DE84003807.

This report is the result of an initial investigation into the feasibility of calculating photopeak efficiency curves for any gamma-ray detection system using the photon-transport capabilities of the INEL RAFFLE Monte Carlo code. It is anticipated that substantial savings in time and money can be realized by using RAFFLE to generate the system photopeak efficiency curve. Additionally, a RAFFLE prediction of a detector-collimator-source efficiency curve might provide important data for the design of collimator/detector systems. The investigative approach consisted of using a modified RAFFLE code to predict the photopeak efficiency curves for two geometries for which experimental curves had been measured. The two geometries included the simple case of a point source emitter located on the detector axis 15.3 cm from the detector end cap, and the more complicated case of a collimated system. The test case for the collimated system was the PBF Fission Product Detection System (FPDS) installation viewing the gas effluent line. Each of these measured curves have an estimated overall error of +-20% from 60 to 250 keV, +-10% from 250 to 1500 keV, and +-15% above 1500 keV. The results of this initial study are given for a point source and a FPDS gas line collimator designed for PBF. Both experimental and calculated responses are given. Some of the reasons for the apparent differences between the calculated and experimental results are discussed. Modifications to the RAFFLE code were necessary in order to score the Ge detector count rate. The computer running times and man-hour costs are given along with recommendations for future modifications to RAFFLE which will improve the computation in the future.

6555 (INIS-mf—8584, pp 11-14) **Participation of Tesla VUPJT in international cooperation of CMEA Member States.** Sedakov, V.; Brantl, K. (Tesla, Premysleni (Czechoslovakia). Vyzkumny Ustav Pristroju Jaderne Techniky). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

The participation is surveyed of TESLA VUPJT in the international cooperation of the CMEA member countries. (B.S.).

6556 (INIS-mf—8584, pp 184-190) **NB 9201 dose rate-meter.** Gregor, J.; Knapp, K.; Severa, L. (Tesla, Premysleni (Czechoslovakia). Vyzkumny Ustav Pristroju Jaderne Techniky). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

The instrument developed is designed for measuring exposure rates between 0.1 $nGy.s^{-1}$ and 200 $nGy.s^{-1}$ in four automatically switched ranges and for measuring exposure between 0.1 nGy and 7 mGy in three manually switched ranges. In measuring exposure, time can be read out from 1 min to 9 hrs 59 mins. An ionization chamber of a volume of approx. 10 l is used as a radiation detector. The electronic part is fully fitted with semiconductors.

6557 **(INIS-mf—8601) Electron spectrometer type 'Miniorange' for in-beam measurements.** Gulyas, J.; Domoni, A.; Kibedi, T.; Krasznahorkai, A.; Fenyes, T.; Sram, Zs. (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete). 1983. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704636.

A new electron spectrometer type 'miniorange' developed in ATOMKI, Debrecen (Hungary) is described. The main components of the detector are Faraday reaction chamber, device for target moving, ring of permanent magnets, Si(Li) detector and auxiliary devices. Maximum efficiency of electron detection is about 10 in full peak. The energy range of electrons detected may be altered simply by moving the magnet ring and detector, without destroying the vacuum. The analysis of measured spectra of internal conversion electrons shows that the application of this simple, cheap and compact detector leads to a remarkable increase in the detection efficiency, of background radiation.

6558 (INIS-mf—8672, pp 107) **Phenomenological model for a description of showers in hadron calorimeters at 10-100 GeV.** Regler, M.; Schmiedmayer, J. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6559 (INIS-mf—8672, pp 107) **Detector of the UA-1 experiment at the CERN proton-antiproton collider.** Wulz, C. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6560 **(LALP—83-45) Los Alamos mini-review. Real-time radiography using x rays and neutrons.** Bryant, L.E. Jr. (Los Alamos National Lab., NM (USA)). Oct 1983. Contract W-7405-ENG-36. 4p. NTIS, PC A02/MF A01. Order Number DE84003682.

The technique of real time radiography is briefly explained, and the advantages of this technique over x-ray film imaging are discussed. (GHT)

6561 **(MPI-PAE-EXP.EL—115) Comparison between argon/methane and argon/ethane gas mixtures in cylindrical drift chambers operating in a high transverse magnetic field.** Binder, U.; Boer, W. de; Grindhammer, G.; Kotthaus, R.; Lierl, H.; Sack, B. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik). Mar 1983. 17p. Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.).

We compare the behaviour of two commonly used gas mixtures argon/methane (90:10) and argon/ethane (50:50) in large cylindrical drift chambers operating in a transverse magnetic field of 1.3 T. The cooler gas argon/ethane was found to exhibit considerably smaller deflection angles, which in our case leads to an improved performance of the chambers. The deflection angles have been determined from a comparison of the experimental non-linear space time relation with the one calculated from a computer simulation of the drift process. For the simulation we use a simple model with only two free parameters. These two parameters are sufficient to obtain an accurate parametrization of the non-linear space time relation.

6562 **(PNL-SA—11337) Portable instrumentation for quantitatively measuring radioactive surface contaminations, including ^{90}Sr.** Brodzinski, R.L. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1983. Contract AC06-76RL01830. 15p. (CONF-831015—25). NTIS, PC A02/MF A01. Order Number DE84003258.

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

In order to measure the effectiveness of decontamination efforts, a quantitative analysis of the radiocontamination is necessary, both before and after decontamination. Since it is desirable to release the decontaminated material for unrestricted use or disposal, the assay equipment must provide adequate sensitivity to measure the radioactivity at or below the release limit. In addition, the instrumentation must be capable of measuring all kinds of radiocontaminants including fission products, activation products, and transuranic materials. Finally, the survey instrumentation must be extremely versatile in order to assay the wide variety of contaminated surfaces in many environments, some of which may be extremely hostile or remote. This communication describes the development and application of portable instrumentation capable of quantitatively measuring most transuranics, activation products, and fission products, including ^{90}Sr, on almost any contaminated surface in nearly any location.

6563 **(PNL-SA—11668) Beta particle measurement and dosimetry requirements at NRC-licensed facilities.** Rathbun, L.A. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1983. Contract AC06-76RL01830. 22p. (CONF-8310143—62). NTIS, PC A02/MF A01. Order Number DE84003345.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

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Beta radiation measurements have been conducted under laboratory and field conditions to assess the degree of measurement problem and offer suggestions for possible remedies. The dosimeters tested included 4 types of film badges, 4 types of TLD badges, and 1 type of pocket ionization chamber. The results indicate there appears to be two types of radiation fields where beta dose rates may be limiting. The first case involves sources which are essentially pure beta emitters (e.g., fuel fabrication facilities). The second, involving commercial nuclear power plants, occurs where sources are very thin and relatively small. Although the results for one type of commercial dosimeter are not yet available, it appears that the typical film and TLD badges used to measure beta doses usually do not respond properly to beta spectra found at NRC-licensed facilities. The pocket ionization chambers do not respond directly to beta particles. However, the bremsstrahlung from the higher energy beta fields will cause the pocket ionization chambers to register some dose. 4 references, 7 figures, 7 tables. (ACR)

6564 **Zone plate shadow camera for 100 keV x rays and 6 MeV protons.** Stone, G.F.; Ceglio, N.M. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Journal of Vacuum Science and Technology, B: Microelectronics Processing and Phenomena;* **1**: No. 4, 1280-1284(Oct 1983). Contract W-7405-ENG-48.

We have fabricated and tested a zone plate coded imaging camera for use with high energy x rays and charged particles. The camera system has demonstrated a higher order resolution capability of 4 μm with 100 keV x rays and 9 μm with 6 MeV protons. The unique components of this zone plate shadow camera are its thick zone plate coded aperture and recording medium for protons. The coded aperture is a free-standing, 75 μm thick, gold micro-Fresnel zone plate with 30 μm minimum zone width. It was fabricated by extending reactive ion etching and gold microplating techniques to "thick" structures. The proton recording medium is CR-39, a polycarbonate plastic, which serves as a high resolution nuclear track detector highly sensitive to protons.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 5667, 5676, 5724, 5727, 5885, 5955, 6356, 6384, 6592

6565 (PTB-E—23) Digital voltage synthesis for the calibration of phase measuring instruments. Braun, A.; Latzel, H.G. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Elektrizitaet). Sep 1982. 16p. (In German). Fachinformationszentrum Energie, Mathematik, Physik, Karlsruhe (Germany, F.R.).

The techniques for digital synthesis of sinewave voltages with adjustable phase angles can be distinguished by the methods used to obtain the phase difference: the content of the solid state memory, containing the desired periodic timerfunctions in tabular form, may be changed, or the adresses may be changed. An error analysis for a method, sensing the same adresses at equal times in two solid state memories after one memory has been loaded with the desired shifted sinewave table shows clearly the influence on word length and the number of steps, which is typical for digital voltage synthesis. The choice of these parameters depends essentially on the technological limit of the analog to digital converters in use. The error analysis gives an estimate for the additional phase error which has to be payed for the increased angular resolution. The practical concept of a phasegenerator is presented with an error < 0.01 degrees in the frequency range 50 Hz-10 kHz.

6566 (SAND—83-7457) Unguided infrared optical communication system for indoor applications. (Isher, Inc., Santa Clara, CA (USA)). Dec 1983. Contract AC04-76DP00789. 95p. NTIS, PC A05/MF A01. Order Number DE84002861.

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The work done during this project clearly indicates that an optical communication system between fixed terminals mounted on ceiling/walls of an igloo type storage facility and movable terminals located at various places in the igloo is feasible. The paper study, with verification by actual tests, indicate that sufficient signal-to-noise can be produced at the receiver by the emission of LED's to communicate between the two terminals. Investigation of the parameters relating to the energy required to operate the movable terminals indicates that the energy expediture levels are within the battery constraints imposed on the system. Information based on actual tests indicates that the movable terminal can operate with an expenditure of approximately 5.3 kJoules of energy over the expected five year lifetime of the system. Projections based on the use of detectors with somewhat larger sensitive areas and a greater number of emitters at the fixed terminal, indicate that the energy consumption could be reduced by approximately a factor of three. This would result in a total usage of only 1.7 kJoules over the five year period. The proposed sytem would have a data rate of 240 kb/s for the Down-link and approximately 17.5 kb/s for the Up-link.

6567 Framing camera tube for subnanosecond imaging applications. Kalibjian, R.; Thomas, S.W. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Review of Scientific Instruments;* **54**: No. 12, 1626-1628(Dec 1983). Contract W-7405-ENG-48.

A dissector/restorer-type framing camera tube has been characterized with a Nd:YAG mode-locked laser. The three-frame format tube, referenced to the photocathode, has a 5 x 5-mm field of view and 0.3-ns duration frames with better than 5 lp/mm spatial resolution. A scan-rate matching technique is described that can increase the framing speed into the subpicosecond range for this type of camera tube.

6568 Measuring the electrical resistance of metals to 40 GPa in the diamond-anvil cell. Reichlin, R.L. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Review of Scientific Instruments;* **54**: No. 12, 1674-1677(Dec 1983). Contract W-7405-ENG-48.

A four-probe technique is described for measuring the electrical resistance of metals in a diamond-anvil cell at pressures up to 40 GPa. The pressure range for electrical resistance measurements was extended by developing insulating gaskets that provide the necessary support for the diamonds and the electrical leads at the diamond edges. The various gasket materials and construction methods that were tested fall into two categories: (1) gaskets made entirely of insulating materials, and (2) gaskets made of metal coated with insulating materials. Gaskets developed in each category were used successfully in making resistance measurements up to 40 GPa. The most reliable gaskets were composites of sheet mica and MgO powder. This report describes the testing and development of the gaskets and presents electrical resistance data obtained for iron and beryllium to 40 GPa.

6569 Circuit for time-resolved photon counting. Kyle, T.G.; Clements, W.E. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Review of Scientific Instruments;* **54**: No. 12, 1790-1792(Dec 1983).

A circuit providing 64 channels of photon counting with time resolutions as small as 50 ns is presented. The circuit requires the photon flux to be sparse enough to neglect multiple photons arriving during a single time-resolution interval.

6570 Optical inspection device. Izzi, E.P. Jr. US Patent Application 6-471,909. 3 Mar 1983. 17p.

A telescopic device is disclosed for conducting inspections of the interior of a boiler furnace for the presence of fuel oil prior to ignition of the furnace. The device includes an elongated furnace tube having a pair of opposed light sources for illuminating areas of the furnace interior and a 90 deg reflecting prism mounted in radial alignment with the light sources at the outer end of the tube for collecting reflected light from the illuminated areas. An optical tube coaxially coupled to the inner end of the furnace tube is provided with an arrangement of achromatic lenses for focusing the collected light with maximum color differentiation so that the true color of the illuminated furnace interior may be viewed. Both tubes together are rotatably coupled to an eye piece assembly including an achromatic ocular lens so that a field of view is provided through 360 deg of rotation.

6571 Nonlinear optical study of interfaces. Chen, C.K. (California Univ., Berkeley); Ricard, D. pp 61-66 of Lasers '81. Collins, C.B. McLean, VA; STS Press (1982). (CONF-811229—). Contract W-7405-ENG-48.

From International conference on lasers; New Orleans, LA, USA (14 Dec 1981).

Surface nonlinear optics becomes particularly important in connection with its potential for the conduction of surface studies. The present investigation has the objective to provide a few examples which illustrate approaches that can be used to study interfaces with the aid of nonlinear optics. The surface-enhancement problem is considered, and it is shown that because of the local-field enhancement, nonlinear optical effects on a rough noble metal surface can be enhanced by several orders of magnitude over those on a smooth surface. The problem of monolayer detection at a silver electrode in an electrolytic solution by second harmonic generation is also discussed. The problem of nonlinear spectroscopic study of adsorbed monolayers on smooth surfaces is explored, taking into account the detection of second harmonic generation (SHG) from dye adsorbates on a fused quartz plate. SHG can be used to study molecular adsorption and desorption at a solid-liquid interface, in particular, at the electrode-electrolyte interface in an electrolytic cell.

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

6572 (MLM—3109-OP) Energetic materials separations and specific polymorph preparations via thermal gradient sublimation. Firsich, D.W. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1983. Contract AC04-76DP00053. 6p. (CONF-8310159—5). NTIS, PC A02/MF A01. Order Number DE84002830.

From Joint symposium on compatibility of plastics/materials with explosives, propellents and pyrotechnics; Lake Ozark, MO, USA (31 Oct 1983).

The principles and methods of thermal gradient sublimation are presented, and experiments showing the application of the technique to energetic materials research are described. Results include the separation of TATB from chlorinated derivatives, the purification of HNAB, and the growth of specific polymorphic forms of HMX and HNAB.

6573 **(MLM—3110(OP)) Surface compatibility studies of potassium perchlorate reaction with pyrotechnic fuels.** Wang, P.S.; Moddeman, W.E.; Bowling, W.C. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1983. Contract AC04-76DP00053. 18p. (CONF-8310159—8). NTIS, PC A02/MF A01. Order Number DE84002829.

From Joint symposium on compatibility of plastics/materials with explosives, propellents and pyrotechnics; Lake Ozark, MO, USA (31 Oct 1983).

Surface sensitive x-ray photoelectron spectroscopy (XPS) and x-ray induced Auger electron spectroscopy (XAES) were used to analyze surface changes in Fe/$KClO_4$, $TiH_{0.65}$/$KClO_4$ and Al foils in $KClO_4$ during accelerated aging at 60 and 120°C. The result shows a 0.02% Cl^- formation per day in Fe/$KClO_4$ and $TiH_{0.65}$/KC $1O_4$ powders aged at 120°C for ≦ 145 days. No $KClO_4$ decomposition was observed under the similar aging conditions in $KClO_4$ samples without pyrotechnic fuels. Titanium oxide to $KClO_4$ signal ratio in a pressed disk of $TiH_{0.65}$/$KClO_4$ was found to be lower than that of the powdered samples. Carbon impurities were noted in all powders, especially strong in metal (or subhydride) containing specimens; carbon impurities were slightly removed from the subhydride during aging.

6574 **Reduction of blast noise with aqueous foam.** Raspet, R.; Griffiths, S.K. (U.S. Army Construction Engineering Research Laboratory, P.O. Box 4005, Champaign, Illinois 61820). *Journal of the Acoustical Society of America;* **74**: No. 6, 1757-1763(Dec 1983).

Experiments were performed to investigate the potential of water-based foams to reduce the farfield noise levels produced by demolitions activity. Measurements of the noise reductions in flat-weighted sound exposure level (FSEL), C-weighted sound exposure level (CSEL), and peak level were made for a variety of charge masses, foam depths, and foam densities (250:1 and 30:1 expansion ratio foams). Scaling laws were developed to relate the foam depth, foam density, and charge mass to noise reductions. These laws provide consistent results for reductions in the peak level, FSEL and CSEL up to a dimensionless foam depth of 2.5. A two part model for the mechanisms of sound level reductions by foam is suggested.

6575 **Effects of overdriven shock states on the equation of state of 9404 explosive.** van Thiel, M.; Lee, E.L.; Cochran, S. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Journal of Applied Physics;* **54**: No. 11, 6760-6763(Nov 1983). Contract W-7405-ENG-48.

Shock wave data above the Chapman Jouguet state of 9404 have been corrected with an improved molybdenum standard equation of state that includes an explicit description of its strength. The results indicate that a large second derivative of pressure with respect to volume is needed to join the isentrope constructed from the Hugoniot data to the expansion isentrope of the Jones—Wilkins—Lee equation of state (EOS) in use now. Possible reasons for this abnormal behavior in the EOS are discussed.

4502 Nuclear

6576 **(LA—9360) Myth of nuclear explosions at waste disposal sites.** Stratton, W.R. (Los Alamos National Lab., NM (USA)). Oct 1983. Contract W-7405-ENG-36. 22p. NTIS, PC A02/MF A01. Order Number DE84003564.

Approximately 25 years ago, an event is said to have occurred in the plains immediately west of the southern Ural mountains of the Soviet Union that is being disputed to this very day. One person says it was an explosion of nuclear wastes buried in a waste disposal site; other people say it was an above-ground test of an atomic weapon; still others suspect that an alleged contaminated area (of unknown size or even existence) is the result of a series of careless procedures. Since the event, a number of articles about the disposal-site explosion hypothesis written by a Soviet exile living in the United Kingdom have been published. Although the Soviet scientist's training and background are in the biological sciences and his knowledge of nuclear physics or chemistry is limited, people who oppose the use of nuclear energy seem to want to believe what he says without question. The work of this Soviet biologist has received wide exposure both in the United Kingdom and the United States. This report presents arguments against the disposal-site explosion hypothesis. Included are discussions of the amounts of plutonium that would be in a disposal site, the amounts of plutonium that would be needed to reach criticality in a soil-water-plutonium mixture, and experiments and theoretical calculations on the behavior of such mixtures. Our quantitative analyses show that the postulated nuclear explosion is so improbable that it is essentially impossible and can be found only in the never-never land of an active imagination. 24 references, 14 figures, 5 tables.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

6577 **(N—8326336) Earth atmosphere ozone model.** Kirchhoff, V.W.J.H. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Apr 1983. 36p. (INPE—2698-PRE/294). NTIS, PC A03/MF A01.

Ozone modeling in the different regions of the atmosphere is discussed. After photochemical considerations of a simple oxygen only atmosphere, the effects of adding hydrogen and nitrogen constituent are shown in the height region between 0 and 140 km. Diffusion effects especially at the atomic oxygen peak are discussed and finally the diurnal variations are calculated for several height levels.

6578 **(N—8327478) DIF1: A dispersion program which can handle pollution and reflection.** Fourie, O.L.; Venter, J.C. (Council for Scientific and Industrial Research, Pretoria (South Africa)). Mar 1982. 67p. NTIS, PC A04/MF A01.

When a nocturnal inversion is broken by turbulent convection which results from heating of the earth's surface, a pollutant plume will be mixed downward and a fumigation condition with high pollutant concentration will arise. When an elevated inversion exists above the mixing layer, the pollutant plume undergoes multiple reflections which influence pollutant concentration levels. The dispersion program DIF considers these two phenomena. The extended program DIF1 is described.

6579 **(N—8327515) A mathematical model of the urban boundary layer.** Holmbom, A.; Svensson, U. (Luleaa Univ., (Sweden)). 1982. 48p. (TULEA—1982-09). NTIS, PC A03/MF A01.

The effects of a sudden change in surface roughness under neutral or stratified atmospheric conditions on mean atmospheric flow and turbulence structure are numerically investigated. A system of partial differential equations is used. Model verification studies using laboratory measurements indicate that numerical prediction of flow over a simulated urban area is realistic.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 5999

6580 **(CONF-830953—1) Monitoring exposure to polynuclear aromatic compounds via room temperature phosphorescence from solid substrates.** Vo-Dinh, T.; Gammage, R.B. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 17p. NTIS, PC A02/MF A01. Order Number DE84003315.

From 7. international solid state dosimetry conference; Ottawa, Canada (27 Sep 1983).

Room Temperature Phosphorescence (RTP) Spectroscopy is a relatively new solid state luminescence technique for monitoring

polynuclear aromatic (PNA) compounds. The RTP technique can detect a variety of PNA pollutants at subnanogram levels. Practical applications include rapid and cost-effective screening of PNA species in complex samples and direct reading detection of airborne PNA compound collected on a new type of personnel vapor dosemeter.

6581 **(CONF-831048—1) Can we delay a greenhouse warming.** Perry, A.M. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 3p. NTIS, PC A02/MF A01. Order Number DE84003390.

From Global carbon cycle - analysis of the natural cycle and implications of anthropogenic alterations for the next century; Knoxville, TN, USA (31 Oct 1983).

The author comments on the EPA report dated September 1983 Can We Delay A Greenhouse Warming? He takes exception to the widely-held interpretation that the answer is not much. The contribution of other greenhouse gases such as methane and nitrous oxide to the EPA scenarios is pointed out, and the lack of understanding of their role is emphasised. (ACR)

6582 **(CONF-831048—2) Chemical and biological processes in CO_2-ocean models.** Baes, C.F. Jr.; Killough, G.G. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 30p. NTIS, PC A03/MF A01. Order Number DE84003304.

From Global carbon cycle - analysis of the natural cycle and implications of anthropogenic alterations for the next century; Knoxville, TN, USA (31 Oct 1983).

The response of the oceans, the ultimate sink for most of the fossil carbon released by man, to increasing atmospheric CO_2 must be predicted reliably over the next hundred years. This will require models sufficiently realistic to be credible, yet simple enough to be verifiable. Besides ocean circulation they should include the inorganic and organic chemistry of carbon. We present here results from a two-dimensional (Latitude X depth) model intended to be such a representation. It consists of an array of boxes arranged in isothermal layers. Water exchange between boxes of the same temperature (advective flow) and exchange between boxes of different temperature (cross-isothermal flow) is parameterized with flux coefficients. The exchange of CO_2 between the atmosphere and a surface box at each temperature is approximated as a linear function of dissolved inorganic carbon (TC) and alkalinity (TA). The photosynthesis rate and calcium carbonate production is assumed proportional to the dissolved nutrient (nitrate) in these surface boxes. Constant detrital fallout velocities are used and the dissolution of organic dentritus in the deep ocean is assumed proportional to its local concentration. Previous steady-state calculations have shown that the observed distribution of carbon, nutrient, oxygen, and ^{14}C with latitude and depth in the oceans may be simulated reasonably well by adjusting a small number of model parameters. Additional steady-state calculations presented here illustrate the substantial effects on carbon distribution between ocean and atmosphere of (1) elimination of photosynthesis, (2) increased nutrient concentration, (3) decreased circulation rate, and (4) increased atmospheric CO_2. 8 references, 5 figures, 6 tables.

6583 **(CONF-8308115—2) Atmospheric deposition to forests.** Lovett, G.M. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 34p. NTIS, PC A03/MF A01. Order Number DE84003384.

From US/Canadian conference on forest responses to acidic deposition; Orono, ME, USA (3 Aug 1983).

The processes of wet and dry deposition in forests are described with special reference to the northeastern United States and to chemical species important in acidic deposition. For wet deposition, it is noted that background or natural pH values are probably in the range of 5 to 7, but current pH values over most of the eastern United States are less than 4.6. Both meteorological and chemical factors influence the acidity of precipitation. The best long-term data record for the northeastern United States (that of the Hubbard Brook Experimental Forest in central New Hampshire) indicates no significant trend in rainfall acidity in the period of record (1964 to 1980), but the data do indicate that nitric acid has increased in importance relative to sulfuric acid in its contribution to that acidity. Deposition decreases along a southwest to northeast transect through the northeastern states. Deposition to high-elevation ecosystems is severalfold higher than deposition to nearby lowland ecosystems because of increased rain and snowfall, the effect of cloud water deposition, and possibly increased dry deposition. Theory and the few measurements available suggest particle deposition to be important for alkaline materials, such as soil dust, and gaseous deposition to be important for H^+, N, and S. The importance of dry deposition relative to wet deposition increases with increasing proximity to pollution source areas. The forest canopy influences atmospheric deposition to the forest floor by taking up or releasing nutrients and strong acidity, releasing weak acidity, and trapping dry depositions. 60 references, 2 figures.

6584 **(CONF-8309130—3) Shoreline environment atmospheric dispersion experiment (SEADEX).** Johnson, W.B.; Uthe, E.E.; Dickson, C.R.; Start, G.; Coulter, R.L.; Kornasiewicz, R.A. (SRI International, Menlo Park, CA (USA). Atmospheric Science Center; National Oceanic and Atmospheric Administration, Idaho Falls, ID (USA). Air Resources Lab.; Argonne National Lab., IL (USA); Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Sep 1983. Contract W-31-109-ENG-38. 15p. NTIS, PC A02/MF A01. Order Number DE84003569.

From 14. international technical meeting on air pollution modeling and its applications; Copenhagen, Denmark (27 Sep 1983).

The purpose of SEADEX was to acquire a comprehensive, high-quality data base for evaluating models of dispersion within coastal zones, it secondary objective was to provide data to help determine which meteorological measurements are most appropriate for emergency preparedness at nuclear power plant sites. The study was conducted in the vicinity of Kewannee, Wisconsin, on the western shore of Lake Michigan. This report describes the design of the study and the data base resulting from it. Both a gas tracer (SF_6) and a particulate tracer (oil fog) were used. (ACR)

6585 **(CONF-8310220—1) Evaluation of wind field interpolation schemes used in studies of regional-scale pollutant transport.** Sheih, C.M. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01. Order Number DE84003634.

From International specialty conference on the meteorology of acidic deposition; Hartford, CT, USA (16 Oct 1983).

Numerical simulations of regional-scale pollutant transport often use wind fields interpolated from observational data of insufficient spatial resolution. Wind data are interpolated to transient puff positions in Lagrangian models, or to a fixed horizontal grid of about 50 to 100 km spacing in Eulerian finite-difference models. The most common interpolation schemes used in regional-scale simulation are: (1) inverse distance weighting; (2) inverse distance-squared weighting; (3) inverse distance-squared and directional weighting (e.g., Heffter, 1980); and (4) nearest station. The study evaluates the above interpolation schemes by carrying out some numerical experiments and comparing the divergences and the trajectories predicted by these schemes.

6586 **(DOE/EV/10405—10) Determination of sulfur speciation in industrial aerosols in an SO_2 rich environment. Final report, 1 June 1980-1 June 1982.** Eatough, D.J. (Brigham Young Univ., Provo, UT (USA). Thermochemical Inst.). 30 Nov 1983. Contract AC02-80EV10405. 44p. NTIS, PC A03/MF A01. Order Number DE84004547.

Several analytical techniques for the determination of organic S(IV) compounds in environmental samples were evaluated, the structure of organic S(IV) was identified as bis-hydroxymethyl sulfone, new analytical procedures for analysis of dimethyl and monomethyl sulfate in particulate samples was developed, and these and existing techniques were applied to the study of the formation of sulfate, the sulfone, and methylated sulfate species in the flue lines and plumes of an oil and a coal-fired power plant. 1. Inorganic S(IV) compounds and bis-hydroxymethyl sulfone are generally not present in primary emissions from coal or oil-fired plants but are formed in the plumes emitted by these facilities; 2. The formation of sulfate from $SO_2(g)$ in the daytime follows kinetics which are first order in $SO_2(g)$ and are temperature dependent; 3. The formation of sulfate from $SO_2(g)$ in the plume of an oil-fired power plant

in a fog bank is about 30% SO_2(g) hr^{-1}. The fog bank reaction may be catalyzed by co-emitted oxidants; 4. Dimethyl and/or monomethyl sulfate have been shown to be present in both flue line and plume samples from coal- and oil-fired power plants; and 5. Methylated sulfates increase in concentration in aerosols during plume transport in the plumes of the power plants studied.

6587 **(EPA—230-09-007) Projecting future sea level rise: methodology, estimates to the year 2100, and research needs.** Hoffman, J.S.; Keyes, D.; Titus, J.G. (Environmental Protection Agency, Washington, DC (USA)). 24 Oct 1983. 126p. US EPA, 401 M St., SW, Washington, DC 20460.

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Concentrations of atmospheric CO_2 and other greenhouse gases will continue to increase in coming decades. Two National Academy of Sciences panels have concluded that higher levels of these gases will almost certainly produce a large global warming. That warming, by thermally expanding the oceans and by causing the transfer of ice and snow resting on land to the oceans, should raise sea level substantially faster than the rise that has taken place during the past century. Although current knowledge is inadequate to make a precise prediction of future sea level rise, it is sufficient to predict the likely range. Many factors were considered in generating the estimates of sea level rise contained in this report: population and productivity growth, atmospheric and climatic change, and oceanic and glacial response. High and low assumptions for these principal determinants of sea level rise were derived from the literature. When linked together the various assumptions allowed the estimation of high and low paths of future sea level rise. 88 references.

6588 **(LBL—16103) Determination of organic oxygen in ambient particulate matter.** Benner, W.H.; Hansen, A.D.A.; Gundel, L.A.; Novakov, T. (Lawrence Berkeley Lab., CA (USA)). Aug 1983. Contract AC03-76SF00098. 8p. (CONF-8309166—7). NTIS, PC A02/MF A01. Order Number DE84002926.

From 2. international conference on carbonaceous particles in the atmosphere; Linz, Austria (11 Sep 1983).

A sample of ambient particulate matter is pyrolyzed in N_2 at 1135°C, and the evolved oxygen is detected by nondispersive infrared spectrometry after conversion to CO. Oxygen in organic compounds, carbonates, silicates, sulfates, nitrates, water, and adsorbed oxygen-containing gases is quantitated; but silica and alumina are not detected. Organic oxygen is determined by analyzing an evaporated extract of the sample. A procedure is also presented for determining oxygen thermograms. The organic fraction of ambient particulate matter is highly oxygenated (C/O $\cong$ 2).

6589 **A regional scale modeling study of the sulfur oxides with a comparison to ambient and wet deposition monitoring data.** Kleinman, L.I. (Brookhaven National Lab., Upton, New York). *Atmospheric Environment;* **17**: No. 6, 1107-1121(1983). Contract AC02-76CH00016.

Monthly average SO_2 and SO_4^{2-} concentrations and wet deposition of total sulfur have been calculated from the AIRSOX (Atmospheric Impact of Residual Sulfur Oxides) long-range transport model and compared with monitoring data from the SURE (Sulfate Regional Experiment) air quality and MAP3S (Multistate Atmospheric Power Production Pollution Study) precipitation chemistry networks. Model output has also been used to determine the rate constants, distance scales and budgets describing the behavior of the sulfur oxides in the eastern US during a summer month. Although the accuracy of these later quantities cannot be directly determined via a comparison with monitoring data, the comparison of monthly average model predictions with observations provides a check on the consistency of the SO/sub x/ time and distance scales. In a spatial area roughly coincident with the SURE monitoring network, it is found that the average distance from source to receptor is 357 km for SO_2 and 583 km for SO_4^{2-}. In the same area, 1/e lifetimes for SO_2, SO_4^{2-} and S are calculated to be 30,105 and 66 h, respectively.

6590 **Case studies of aerosol size distribution and chemistry during passages of a cold and a warm front.** Sheih, C.M.; Johnson, S.A.; DePaul, F.T. (Argonne National Laboratory, IL). *Atmospheric Environment;* **17**: No. 7, 1299-1306(1983).

Surface-based measurements of particle size distributions, mass, water content, and the ammonium, sulfate and nitrate ion concentrations of atmospheric aerosols, centered around precipitation events associated with cold and warm frontal passages, are reported. In both cases precipitation scavenges coarse aerosols (diameters > 1.5 μm) considerably more efficiently than it removes fine aerosols (diameters < 1.5 μm). The concentration of the coarse mode recovers to near pre-rain levels 3-4 h after the rain for both cases. The rates of precipitation scavenging on the coarse mode are found to be about 48 and 67% h^{-1} for the cold and warm front cases, respectively. The corresponding value for the fine mode is about 32% h^{-1} for the warm front case, which had little wind shift and thus no change of source region, but no estimate is made for the cold front case because of the marked wind shift. An estimate of the water content of the ambient aerosol indicates that, at times, as much as 95% of the aerosol mass may be water. With few exceptions, significant increases in the concentrations of aerosol mass and the above chemical components have been observed at the onset of rain, with the nitrate ion increase being most dramatic. Ammonium sulfate is found almost exclusively in the accumulation mode while the ammonium nitrate content varies between the accumulation mode and the larger particle mode.

6591 **Some environmental effects of forest fires in interior Alaska.** Eaton, F.; Wendler, G. (Univ. of Alaska, Fairbanks). *Atmospheric Environment;* **17**: No. 7, 1331-1337(1983). Contract FG06-77ET20181.

The high variability of burning conditions and fuels, found in Alaskan forest fires, produces an associated complex emission of particulate matter. Histological evidence of some large particles has been found in the forest fire plumes as well as aerosols resulting apparently from gas-to-particle conversion. Particles analyzed with a scanning electron microscope and X-ray energy dispersive techniques show forest fire smoke affects atmospheric turbidity regionally. Turbidity values presented which were measured in the plume from a forest fire 400 km from Fairbanks show values in excess of those found for heavily polluted urban regions. The particulate matter analysis showing irregular shapes and highly varied chemical composition displays the difficulty in radiative transfer calculations due to the assumptions of Mie theory. The nature of the aerosol size concentrations (non-Junge power law distributions) found in forest fire plumes also violates the assumption necessary for application of Angstroem's classic method of defining the turbidity coefficient and wavelength exponent. Consequences of such particulate matter may affect the temperature structure of the atmosphere, radiation balance as well as visibility. In addition, the burnt over forest regions display a reduction of surface albedo and roughness parameter which will have prolonged influence on the heat exchange at the earth's surface.

6592 **Determination of ambient aerosol and gaseous sulfur using a continuous fpd - III. Design and characterization of a monitor for airborne applications.** Garber, R.W.; Daum, P.H.; Doering, R.F.; D'Ottavio, T.; Tanner, R.L. (Brookhaven National Lab., Upton, NY). *Atmospheric Environment;* **17**: No. 7, 1381-1385(1983).

A dual flame photometric detector for measurement of SO_2 and aerosol sulfur from aircraft platforms has been developed. Mass-flow controllers are used to maintain a constant flow of sample air and hydrogen to the FPD burners as altitude varies. This eliminates the variation in the sulfur signal with altitude usually observed in conventional designs and greatly reduces the altitude variation in the flame background signal. Sulfur dioxide and aerosol sulfur are differentiated by placing a quartz filter before the SO_2 detector and a litharge denuder before the aerosol sulfur detector. Sensitivity of the detector is enhanced by use of hydrogen doped with 100 ppb SF_6. Performance of the instrument during pressure chamber tests and on test flights is discussed.

6593 **The ubiquity of peroxyacetyl nitrate in the continental boundary layer.** Spicer, M.W.; Holdren, M.W.; Keigley, G.W. (Battelle Columbus Laboratories, Columbus, OH). *Atmospheric Environment;* **17**: No. 5, 1055-1058(1983).

Although peroxyacetyl nitrate (PAN) is generally considered to be an urban pollutant of relatively short lifetime, it has been measured at significant concentrations (0.1 ppb) in rural and remote locations and during all seasons. This communication reports the results of several recent measurement programs and speculates on the importance of these observations.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 5808, 5809, 6269

5006 Regulations

REFER ALSO TO CITATION(S) 5989

6594 **(DOE/PE/70045—T7) Review of proposed changes to emission standards for cars and heavy-duty trucks.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). 15 Dec 1981. Contract AC01-78PE70045. 21p. NTIS, PC A02/MF A01. Order Number DE84003942.

Existing environmental standards for cars and heavy-duty trucks (HDT) are reviewed. The various proposals to both Senate and Congress for revising automotive and HDT emission standards, respectively, are summarized. A new concept in emission control known as the bubble concept is described, where emission standards apply to the entire fleet on average as opposed to current requirements for each engine family. Proposed changes to certification and compliance procedures are described which indirectly influence the actual emission levels that new vehicles are calibrated to meet. A brief summary of the different proposals is provided and selection of the two scenarios to be utilized to gauge the impact on fuel economy obtained by existing technology is detailed. (MHR)

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5102 Chemicals Monitoring And Transport

6595 **(CONF-8308141—1) Species interactions.** Suter, G.W. II. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 28p. NTIS, PC A03/MF A01. Order Number DE84003297.

From Workshop on methods for assessing the effects on non-human biota of mixtures of chemicals; Guildford, Surrey, UK (15 Aug 1983).

This paper illustrates and discusses the following conclusions: (1) species interactions have been studied in numerous laboratory systems that might be adapted for toxicity testing; (2) species interactions could significantly alter toxicant effects, and vice versa; (3) effects of toxicants on species interactions (as opposed to direct toxicant-induced effects on the population size of one species which subsequently affects other species through trophic or competitive interactions) have received limited attention in field studies; (4) laboratory studies of toxicants and species interactions are rare relative to other types of toxicological studies; (5) a few species interactions could be readily and beneficially included in hazard assessments; and (6) there is no pressing need for the development of additional tests of species interactions until we better understand the role of species interactions in toxicological responses in the field. 60 references.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 5793, 6269, 6672

6596 **(PNL—4713) Comparison of environmental radiation doses estimated for Hanford Operations, 1977 through 1982.** McCormack, W.D.; Carlile, J.M.V.; Peloquin, R.A.; Napier, B.A. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1983. Contract AC06-76RL01830. 50p. NTIS, PC A03/MF A01. Order Number DE84003192.

Offsite environmental radiation dose equivalents based on Hanford operations are compared for the years 1977 through 1981 to those calculated for 1982. The comparison revealed a downward trend in calculated offsite doses over the period 1977 through 1982, due primarily to reported reduced effluent releases, changes in effluent reporting methods, and increased Columbia River flow over this period. The calculated doses verify the surveillance program findings that potential offsite radiation doses due to Hanford Operations are small and well below our ability to detect in the environment. 11 references, 23 tables.

6597 **(ORNL-tr—5060) Doses from potential inhalation by people living near plutonium contaminated areas.** Iranzo Gonzales, E.; Salvador Ruiz, S. (Oak Ridge National Lab., TN (USA); Junta de Energia Nuclear, Madrid (Spain)). Sep 1983. Contract W-7405-ENG-26. Translation source information not available . 74p. NTIS, PC A04/MF A01. Order Number DE84004956.

An aviation accident above the town of Palomares, Spain resulted in four thermonuclear bombs carried by one of the planes falling. The nuclear fuel in two of them ignited and formed an aerosol which contaminated a 226-hectare area of underbrush, farmland and an urban center. The magnitude of risk to people living in the area who may have inhaled the plutonium aerosol or dusts during the fifteen-year period since the time the accident is addressed in this report. In addition the internal radiation doses that people may have received during this period and during a fifty-year period commencing with the accident is estimated. In brief summary, the lungs received the greatest dose equivalent (1966 to 1980). Over the fifty year period (to 2015) the bones are projected to receive the greatest dose. For the remaining organs - liver-intestines-kidneys, - the relationships or between the doses that will be accumulated up to the year 2015 and the corresponding annual dose equivalent limits are less than those for the bones and lungs.

6598 **An evaluation of soil sampling for 137Cs using various field-sampling volumes.** Nyhan, J.W.; White, G.C.; Schofield, T.G.; Trujillo, G. (Los Alamos National Laboratory, NM). *Health Physics;* **44**: No. 5, 541-552(May 1983).

The sediments from a liquid effluent receiving area at the Los Alamos National Laboratory and soils from an intensive study area in the fallout pathway of Trinity were sampled for 137Cs using 25-, 500-, 2500- and 12,500-cm3 field sampling volumes. A highly replicated sampling program was used to determine mean concentrations and inventories of 137Cs at each site, as well as estimates of spatial, aliquoting, and counting variance components of the radionuclide data. The sampling methods were also analyzed as a function of soil size fractions collected in each field sampling volume and of the total cost of the program for a given variation in the radionuclide survey results. Coefficients of variation (CV) of 137Cs inventory estimates ranged from 0.063 to 0.14 for Mortandad Canyon sediments, whereas CV values for Trinity soils were observed from 0.38 to 0.57. Spatial variance components of 137Cs concentration data were usually found to be larger than either the aliquoting or counting variance estimates and were inversely related to field sampling volume at the Trinity intensive site. Subsequent optimization studies of the sampling schemes demonstrated that each aliquot should be counted once, and that only 2-4 aliquots out of as many as 30 collected need be assayed for 137Cs. The optimization studies showed that as sample costs increased to 45 man-hours of labor per sample, the variance of the mean 137Cs concentration decreased dramatically, but decreased very little with additional labor.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 5788, 5937

6599 **(CONF-8211135—1) Development of ectomycorrhizae on containerized sweet birch and European alder seedlings for planting on low quality sites.** Walker, R.F.; West, D.C.; McLaughlin, S.B. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 10p. NTIS, PC A02/MF A01. Order Number DE84003374.

From 2. biennial Southern Silvicultural Research conference; Atlanta, GA, USA (4 Nov 1982).

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A study was initiated to assess the potential of Pisolithus tinctorius as an ectomycorrhizal associate of containerized sweet birch (Betula lenta) and European alder (Alnus glutinosa) seedlings and to determine the effect of this fungal symbiont on seedling growth. In a test of sweet birch and European alder grown in Leach tubes, P. tinctorius formed abundant ectomycorrhizae on sweet birch when introduced via a vegetative mycelial inoculum. Cenococcum geophilum, originating from sclerotia present in the potting medium, and Thelephora terrestris, introduced via windborne propagules, formed ectomycorrhizae on the sweet birch seedlings inoculated with P. tinctorius and on the sweet birch control seedlings. C. geophilum also formed ectomycorrhizae on the inoculated and control European alder seedlings, but an inoculation with P. tinctorius did not result in the formation of P. tinctorius ectomycorrhizae on this host. Sweet birch seedlings infected with P. tinctorius had a greater dry weight, height, root collar diameter, and volume and a lower shoot/root ratio than the sweet birch control seedlings, and European alder seedlings with abundant C. geophilum ectomycorrhizae exhibited a similar improvement in growth in comparison with European alder with lesser C. geophilum infections. The inoculation of containerized sweet birch and European alder seedlings in the nursery with the appropriate ectomycorrhizal symbiont may facilitate the establishment of these species on harsh sites such as surface mine spoils. 57 references, 3 tables.

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

REFER ALSO TO CITATION(S) 6737

6600 **Relative effectiveness of two ichthyoplankton sampling techniques.** Cada, G.F.; Loar, J.M. (Oak Ridge National Lab., TN). *Canadian Journal of Fisheries and Aquatic Science;* **39**: No. 6, 811-814(Jun 1982). Contract W-7405-ENG-26.

Two common ichthyoplankton sampling devices, a pump and a conical plankton net, were evaluated for their relative effectiveness in collecting various sizes of clupeid larvae in the headwaters of Watts Bar Reservoir in eastern Tennessee. Triplicate surface pump and towed-net samples were taken during both day and night on three dates in June 1979 to detect any diel differences in sampler effectiveness. Clupeid larvae, 4-10 mm long, were collected in numbers large enough to make meaningful statistical comparisons of the two techniques. The differences in the mean densities of most length groups between nighttime pump and tow samples were not statistically significant. During the day, however, the pump collected significantly more 4-mm larvae and the towed net collected more 5- to 10- mm larvae. Our results indicate that under conditions by which these samplers are commonly deployed in open waters, most sizes of young shad larvae exhibited a greater ability to avoid the pump sampler than the towed net during the daytime.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 5762, 6338, 6339, 6582, 6735

6601 **(CONF-8310179—6) Photolysis rates of selected polynuclear aromatic hydrocarbons in aqueous coal-oil systems.** Picel, K.C.; Stamoudis, V.C.; Simmons, M.S. (Argonne National Lab., IL (USA); Michigan Univ., Ann Arbor (USA). Dept. of Environmental and Industrial Health). 1983. Contract W-31-109-ENG-38. 17p. NTIS, PC A02/MF A01. Order Number DE84004019.

From 8. international symposium on polynuclear aromatic hydrocarbons; Columbus, OH, USA (26 Oct 1983).

Four polynuclear aromatic hydrocarbons (PAH) from the neutral fraction of synfuels materials - fluoranthene (FLA), pyrene (PY), benzo[a]anthracene (BaA), and benzo[a]pyrene (BaP) - were selected as representative test compounds based on toxicity, abundance, and chemical characteristics. BaA and BaP are established carcinogens, and FLA is a suspected cocarcinogen. Pyrene, which is not thought to be carcinogenic, was included for comparison to FLA, which has the same molecular weight but different structural properties. The synthetic fuel material used in this study was CRM-1, a coal-oil comparative research material obtained from Oak Ridge National Laboratory. For PY, BaA, and BaP in aqueous systems, initial photolysis rates are six to nine times lower in coal-oil (CRM-1) saturated water than in pure water. However, the photolysis rate of FLA is not significantly different under the same conditions. It is possible that the photochemical mechanisms inhibited in the photoreactive PAH are not operational in FLA. Since the calculated light attenuation can account only partially for the observed reduction of the photolysis rates of PY, BaA, and BaP, it is likely that other factors - especially the presence of phenols - are affecting the photodegradation process of these PAH. Further studies are needed to investigate the individual effects on PAH photolysis rates of the various classes of compounds that make up the coal-oil matrix. 20 references, 2 figures, 4 tables.

6602 **(N—8326319) Contaminant inputs to the Hudson-Raritan estuary.** Mueller, J.A.; Gerrish, T.A.; Casey, M.C. (National Oceanic and Atmospheric Administration, Boulder, CO (USA)). Aug 1982. 315p. (NOAA-OMPA—21). NTIS, PC A14/MF A01.

Source locations and an estimate of the magnitude of contaminant inputs to the Hudson-Raritan Estuary are presented. The relative contribution of the various sources is indicated and data gaps are identified. Six sources of contaminant inputs were evaluated: nontidal tributary, municipal and industrial wastewater, atmospheric, urban runoff, accidental spills, and landfill leachate. The latter five sources were evaluated downstream of the tributary water quality stations, since sources above these points are reflected in the tributary inputs. In addition to flow or volume for each source, data on concentrations of conventional pollutants (solids, organic matter, nutrients, and bacterial indicators), organic toxics, and heavy metals were sought. A large quantity of data was obtained from numerous federal, state, county, and municipal agencies, and private firms. The data were analyzed to obtain average mass loads of specific contaminants into the Hudson-Raritan Estuary.

6603 **(N—8326419) Utilization of aquatic organisms for continuously monitoring the toxicity of industrial waste effluents.** Vanderschalie, W.H. (Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD (USA)). Apr 1982. 23p. NTIS, PC A16/MF A01.

In Proc. of the 12th Conf. on Environ. Toxicol., p 370-392 (SEE N83-26400 15-51).

Use of aquatic organisms to monitor waste toxicity continuously is considered. The requirements for such a work approach are discussed, data from a field test of one system are described, and subsequent improvements in one type of monitoring system are detailed.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 5797, 5805, 5806, 5808, 5809, 5811, 6735

6604 **(DOE/CS/40186—T1) Effects of irrigation well efficiency on energy requirements. Final report.** Werner, H.D.; Scherer, T.F.; Kajer, T.O. (Minnesota Univ., St. Paul (USA). Dept. of Agricultural Engineering). Oct 1980. Contract AC01-78CS40186. 111p. NTIS, PC A06/MF A01. Order Number DE83017850.

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The objectives of this study were to determine the effects of several factors on the performance of a high production irrigation well. The study involved the drilling of ten wells. Each well was either constructed with different materials, such as a different style of screen or type of gravel pack, or it was drilled using a different drilling fluid. Three development methods were used on each well, specifically; overpumping, surging, and high pressure jetting with air lift pumping. After each well was developed, a pump-test was performed. For a pump-test, one well was pumped and the others acted as observation wells. The drawdown in the pumped well, the drawdown in the observation wells, and the flowrate were recorded for 24 hours. A 24 hour recovery period was also recorded. The data obtained was evaluated graphically to determine the aquifer parameters, T and S/sub y/. These values were used to calculate the theoretical drawdown and consequently the efficiency of each well. From the differences recorded in the 3 pump-tests performed on each well, the response of the wells to development was determined.

6605 (INIS-mf—8584, pp 42-45) **Monitoring of hydrosphere radioactivity in the vicinity of Dukovany nuclear power plant.** Stanek, Z. (Vyzkumny Ustav Vodohospodarsky, Brno (Czechoslovakia)). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

The natural radiation background was studied in the vicinity of the Dukovany nuclear power plant under construction. Radiometric analysis was used for measurements using samples of surface, ground and precipitation waters and aquatic materials. The radionuclides under study included ^{226}Ra, ^{90}Sr, ^{137}Cs, tritium, ^{40}K and natural uranium.

5204 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 6696

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 5698, 5699

5206 Regulations

6606 **Research needs of the Clean Water Act. Hearings before the Subcommittee on Natural Resources, Agriculture Research and Environment of the Committee on Science and Technology, US House of Representatives, Ninety-Seventh Congress, Second Session, June 8, 10, 1982.** Washington, DC; Government Printing Office (1983). 665p. Government Printing Office, Washington, DC.

Officials of local, state, and federal environmental agencies, as well as university professors and a representative of the Chemical Manufacturers Association suggested research programs that would help meet the Clean Water Act goal of fishable and swimmable water by 1983. The success of the existing legislation is marred primarily by continuing problems with chemical wastes because of a lack of information in point and nonpoint sources, groundwater systems, and industrial and municipal sludge. While the witnesses acknowledged the need for further research in these areas, they took credit for accomplishments to date. (DCK)

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social And Economic Studies

REFER ALSO TO CITATION(S) 6030

5302 Assessment Of Energy Technologies

6607 **(CONF-831205—3) Energy, innovation, and the business cycle: proof and policy.** Santini, D.J. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01. Order Number DE84003644.

From 6. Miami international conference on alternative energy sources; Miami Beach, FL, USA (12 Dec 1983).

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Each theory reviewed implies that invention and innovation will expand economic growth. The theories differ in their short run policy implications. The author's theory is unique with respect to its prediction of negative short run macroeconomic effects of energy related innovation. It predicts that intermediate term research and development specifically addressed toward technical demonstration of moderately uneconomic (i.e. excessively costly) energy efficient technologies will pay off handsomely during an energy price shock by softening the negative impacts (lost sales) of transitions from more to less energy intensive products.

6608 **Untersuchung ueber Entstehungsbedingungen von Risikoeinstellungen gegenueber grosstechnischen Anlagen. (Investigation of the modes of origin of attitudes concerning the risks of large-scale technical plants. Study into the technical, organisational and sociological conditions governing risk strategies in the field of technological development).** Gutmann, G.; Huschke, P. Frankfurt am Main, Germany, F.R.; Battelle-Institut e.V. (1980). 98p. (In German). Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.).

A hypothetical framework of the modes of origin of attitudes concerning the risks of large-scale industrial plants is developed. The hypotheses regarding the assessment of nuclear energy are empirically investigated in several schools, the pupils being between 14 and 16 years old. Results: 1. the "polarity" of opinion patterns on the problem of nuclear energy "brought along", i.e. already coined within the families could not be reversed by school instruction. 2. Instruction can possibly differentiate attitudes (assessments and cognitions). 3. Obviously the teaching style of the teacher is more determining for a differentiated attitude towards nuclear energy than the instruction material used. 4. A teaching style supporting and activating differentiation can be called partner-orientated and "provocative" and be considered as taking into consideration the communicative situations in school classes in a flexible manner. 5. On the other hand, a frontal and monologizing teaching style which does not respond to the changing communicative structures in school classes can block all interest and thus the possibility of influencing attitudes.

5303 Environmental Impact Statements

6609 **(NP—4900010) Final Environmental Impact Statement: proposed Southern California lease offering, April 1984. Volume 1.** (Minerals Management Service, Los Angeles, CA (USA). Pacific OCS Region). Dec 1983. 725p. USDI, Minerals Management Service, 1340 W Sixth St., Los Angeles, CA 90017.

The proposed action is the offering for lease of those unleased blocks from Point Conception to the California-Mexico border. Approximately 11.6 million acres are located within the boundary of the proposed lease offering. This Final Environmental Impact Statement examines impacts to water quality, air quality, intertidal benthos, subtidal benthos, mortality to marine mammals, seabirds, and endangered brown pelicans, public water supplies, visual resources, cultural resources, and military operations. (ACR)

6610 **(NP—4900206) St. George Basin. Final supplemental environmental impact statement.** (Minerals Management Service, Anchorage, AK (USA). Alaska Outer Continental Shelf Region). 1983. 177p. NTIS, PC A03. Order Number DE84900206.

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This final supplemental environmental impact statement (EIS) discusses the effects of geophysical seismic activities and evaluates the risk of a very large oilspill (100,000 barrels or greater) on gray and right whales within the St. George Basin lease offering area. The environmental analysis focuses on oil and gas leasing activities on 96 tracts that received bids. Preliminary seismic activities (both deep and high-resolution) associated with the lease offering are not expected to adversely affect the gray and right whale population fitness in the Sale 70 area. The probable degree of regional impact is considered NEGLIGIBLE for right whales. Since almost the entire population of gray whales migrates through a portion of the Sale 70 area, the probable degree of regional impact could be MINOR. Significant population-wide direct effects from oilspills would be unlikely. The probable degree of regional impact on gray and right whales is considered NEGLIGIBLE.

6611 **(NP—4900404) Final Environmental Impact Statement: proposed Southern California lease offering, April 1984. Volume 2.** (Minerals Management Service, Los Angeles, CA (USA). Pacific OCS Region). Dec 1983. 769p. USDI Minerals Management Service, 1340 W Sixth St., Los Angeles, CA 90017.

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The proposed action is the offering for lease of those unleased blocks from Point Conception to the California-Mexico border. Approximately 11.6 million acres are located within the boundary of the proposed lease offering. This Final Environmental Impact Statement examines impacts to water quality, air quality, intertidal benthos, subtidal benthos, mortality to marine mammals, seabirds, and endangered, brown pelicans, public water supplies, visual resources, cultural resources, and military operations. (ACR)

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5502 Biochemistry

REFER ALSO TO CITATION(S) 6629, 6631, 6697, 6699, 6708, 6723

6612 (CONF-8205230—Summ., pp 124-127) **Viral oncology as related to cancer risk assessment.** Astrin, S.M. (Inst. for Cancer Research, Philadelphia, PA). Sep 1983. NTIS, PC A09/MF A01.

From Conference on establishment of a bioassay system for cancer risk assessment in energy technology; Baltimore, MD, USA (3 May 1982).

It now appears extremely probable that the viral transforming genes are derived by a recombinational process from the cell genome. That is, each of the 15 or more oncogenes as a homologue present in normal vertebrate cells. Each of these genes is present in all vertebrates tested to date. Thus, the genes are highly conserved in evolution, leading one to believe that they perform an essential function. Preliminary information on the expression of oncogenes in normal tissue indicates that they may be expressed early in development of selected tissues and organs. It is possible that the expression of each of these genes is tissue specific and that expression is linked to proliferation and/or differentiation of a given cell lineage. Given the fact that these genes, when carried by a retrovirus, induce neoplastic transformation, is it likely that activation of the appropriate oncogene in a target cell can trigger neoplasia. In other words, do viruses transform cells by overloading them with what is otherwise a normal cellular product.

6613 **(CONF-8306144—1) Neutron diffraction of α, β and γ cyclodextrins: hydrogen bonding patterns.** Hingerty, B.E.; Klar, B.; Hardgrove, G.; Betzel, C.; Saenger, W. (Oak Ridge National Lab., TN (USA); Institut Max von Laue - Paul Langevin, 38 - Grenoble (France); Saint Olaf Coll., Northfield, MN (USA); Freie Univ. Berlin (Germany, F.R.). Inst. fuer Kristallographie). 1983. Contract W-7405-ENG-26. 16p. NTIS, PC A02/MF A01. Order Number DE84003175.

From Symposium on conversation in biomolecular stereodynamics III; Albany, NY, USA (7 Jun 1983).

Cyclodextrins (CD's) are torus-shaped molecules composed of six (α), seven (β) or eight (γ) ($1 \rightarrow 4$) linked glucoses. α-CD has been shown to have two different structures with well-defined hydrogen bonds, one tense and the other relaxed. An induced-fit-like mechanism for α-CD complex formation has been proposed. Circular hydrogen bond networks have also been found for α-CD due to the energetically favored cooperative effect. β-CD with a disordered water structure possesses an unusual flip-flop hydrogen bonding system of the type O-H H-O representing an equilibrium between two states; O-H O reversible H-O. γ-CD with a disordered water structure similar to β-CD also possesses the flip-flop hydrogen bond. This study demonstrates that hydrogen bonds are operative in disordered systems and display dynamics even in the solid state.

6614 **(DOE/ER/10700—T1) Fluorescence photobleaching measurements of plant membrane viscosity: effects of environmental stress.** Breidenbach, R.W.; Rains, D.W.; Saxton, M.J. (California Univ., Davis (USA)). 1983. Contract AT03-80ER10700. 12p. NTIS, PC A02/MF A01. Order Number DE84004953.

Correct interpretation of photobleaching results depends on knowing that the label is confined to the plasma membrane. In the case of labels such as lectins, fluorescent glycosides, oligosaccharide elicitors and antibodies that bind to external determinants on the membrane, proper interpretation will depend on knowing as much as possible about the binding sites of the labels in the membrane. We have developed procedures to characterize binding to intact membrane vesicles, detergent-solubilized membrane proteins, lipid fractions and solubilized proteins resolved by 2D gel electrophoresis/isoelectric focusing. Using these methods we have been able to characterize and compare the binding of several ^{125}I-labeled lectins.

6615 **(DOE/EV/05888—06) Impact of energy-related pollutants on chromosome structure. Progress report, January 1, 1981-October 1, 1983.** Rill, R.L. (Florida State Univ., Tallahassee (USA). Inst. of Molecular Biophysics). 1983. Contract AS05-78EV05888. 20p. NTIS, PC A02/MF A01. Order Number DE84003441.

This report covers work which can be divided into four areas: (1) we have shown that the 7-position of guanine in DNA within native chromatin (in nuclei) reacts randomly with the simple alkylating agents dimethyl sulfate and diethyl sulfate, demonstrating that the higher order structure of chromatin does not influence the reactivity of this DNA site; (2) the topography of the nucleosome core surface was probed using an arginine-specific protease and chymotrypsin. Several exposed histone sites were identified. Carbon-13 NMR studies showed tht most DNA in isolated nucleosome cores is immobilized by histone binding, but several lysine-rich segments of core histones, including residues 1 to 30 of H2b, are highly mobile; (3) we have shown that the soluble fraction of chromatin most rapidly released from mouse myeloma and chicken erythrocyte nuclei as mono- and small oligonucleosomes by micrococcal nuclease is significantly enriched in transcribed genes and newly replicated DNA; and (4) we have shown that the early histone genes of L.variegatus are arranged in a 7 kb cluster that is tandemly repeated at least 150 times in the haploid genome, and have mapped several restriction endonuclease sites in the cluster. We are also investigating histone variants and nucleosome repeat lengths found at different embryonic stages.

6616 **(DOE/EV/70032—T2) Studies on the repair of damaged DNA in bacteriophage, bacterial and mammalian systems. Comprehensive report, 1 February 1981-15 September 1983.** Friedberg, E.C. (Stanford Univ., CA (USA). Dept. of Pathology). 1983. Contract AT03-76EV70032. 11p. NTIS, PC A02/MF A01. Order Number DE84004998.

We have explored the molecular mechanism of the repair of DNA at a number of different levels of biological organization, by investigating bacteriophage, bacterial, yeast and mammalian (including human) cells. We have demonstrated that uv endonuclease of phage T4 not only possesses pyrimidine dimer (PD)-DNA glycosylase activity but also apyrimidinic (AP) endonuclease activity. The demonstration of both activities provided an explanation for the specific endonucleosytic cleavage of DNA at sites of pyrimidine dimers catalyzed by this small protein. A new apurinic/apyrimidinic (AP) endonuclease, specific for sites of of base loss in single stranded DNA has been isolated from E. celi and presumably recognizes these lesions in single stranded regions of duplex DNA. We have partially purified this enzyme and have carried out a preliminary characterization of the activity. We treated xeroderma pigmentosum and normal cells with sodium butyrate in the hope of restoring normal levels of excision repair to the former. Although this result was not obtained, we established that all cells treated with sodium butyrate show enhanced levels of repair synthesis, thus providing a means for increasing the sensitivity of this commonly used technique for measuring DNA repair in mammalian cells in culture.

6617 (INIS-BR—78, pp 3) **Conformational properties of spin-labeled angiotensin derivatives.** Nakaie, C.R.; Schreier, S.; Paiva, A.C.M. (Escola Paulista de Medicina, Sao Paulo (Brazil); Sao Paulo Univ. (Brazil). Inst. de Quimica). 1982. NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

6618 (INIS-BR—78, pp 4) **Hemoglobin oxidation by copper: a study by EPR.** Louro, S.R.W. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Dept. de Fisica); Tabak, M. (Sao Paulo Univ., Sao Carlos (Brazil). Inst. de Fisica e Quimica). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

6619 (INIS-BR—78, pp 5) **Localization of the copper binding sites in hemoglobin: magnetic interaction with spin labels and iron.** Louro, S.R.W. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Dept. de Fisica); Tabak, M. (Sao Paulo Univ., Sao Carlos (Brazil). Inst. de Fisica e Quimica). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

6620 (INIS-BR—78, pp 7) **Comparative study of myoglobins marked with nitric oxide using EPR.** Caracelli, I.; Nascimento, O.R.; Tabak, M. (Sao Paulo Univ., Sao Carlos (Brazil). Inst. de Fisica e Quimica). 1982. NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

6621 (INIS-BR—78, pp 8) **EPR studies of Applysia myoglobin.** Baffa Filho, O.; Say, J.C. (Sao Paulo Univ., Ribeirao Preto (Brazil). Faculdade de Filosofia, Ciencias e Letras); Tabak, M.; Nascimento, O.R. (Sao Paulo Univ., Sao Carlos (Brazil). Inst. de Fisica e Quimica). 1982. NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

6622 (INIS-BR—78, pp 13) **Microcrystal studies of bones.** Baffa Filho, O. (Sao Paulo Univ., Ribeirao Preto (Brazil). Faculdade de Filosofia, Ciencias e Letras); Olivieri, J.R. (Fundacao Educacional de Barretos, Sao Paulo (Brazil)); Nascimento, O.R. (Sao Paulo Univ., Sao Carlos (Brazil). Inst. de Fisica e Quimica). 1982. NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

6623 (INIS-BR—78, pp 15) **Proton NMR spin-spin relaxation in hydrated insulin powder.** Sanches, R.; Donoso, J.P.; Mascarenhas, S.; Panepucci, H.C. (Sao Paulo Univ., Sao Carlos (Brazil). Inst. de Fisica e Quimica). 1982. NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

6624 (INIS-BR—78, pp 16) **Study on thermal variation of electron paramagnetic resonance of hemoglobin and myoblobin.** Wajnberg, E.; Kalinowski, H.J.; Bemski, G. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Dept. de Fisica). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

6625 (INIS-BR—78, pp 17) **Molecular cryobiology: a new approach using saturation transfer-electron paramagnetic resonance to the study of the interaction between cryoprotectors and membrane proteins.** D'Avila Nunes, M. (Sao Paulo Univ. (Brazil). Inst. de Ciencias Biomedicas). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

6626 (INIS-BR—78, pp 18) **Molecular cryobiology: interactions between cryoprotectors and human erythrocyte phospholipides analysed by conventional electron paramagnetic resonance.** D'Avila Nunes, M. (Sao Paulo Univ. (Brazil). Inst. de Ciencias Biomedicas). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

6627 (INIS-mf—8591, pp 107) **Cordycepin and its action on the synthesis of polyribosomes in excised pumpkin cotyledones.** Ananiev, E.; Georgiev, G. (Bylgarska Akademiya na Naukite, Sofia. Inst. po Fiziologiya na Rasteniyata). Oct 1981. NTIS (US Sales Only), PC A07/MF A01. (CONF-8110297—Summ.).

From 3. symposium on plant growth regulators; Varna, Bulgaria (18 Oct 1981).

5503 Cytology

REFER ALSO TO CITATION(S) 6661, 6685

6628 (CONF-8205230—Summ., pp 93) **Human cell transformation studies.** McCormick, J.J. (Michigan State Univ., East Lansing). Sep 1983. NTIS, PC A09/MF A01.

From Conference on establishment of a bioassay system for cancer risk assessment in energy technology; Baltimore, MD, USA (3 May 1982).

It is important to realize that human cell transformation (i.e., induction of anchorage-independent growth) has characteristics very similar to the induction of thioguanine-resistance in these same cells. The similarities include the dose response with various agents; the need for expression time; a similar response of XP and normal cells in both assays; a similar response of synchronized cells treated with agents at S and far from S (early G1), and the fact that a background of naturally occurring anchorage-independent and thioguanine-resistant cells exist in both assays. These similarities of response between induction of thioguanine-resistance, a known mutagenic marker, and induction of anchorage-independence suggest that the latter occurs as a mutagenic event. However, previous transformation assays, including human, either did not show this correlation or showed it much less clearly. The lack of correlation relates, in part, to the failure to set up transformation assays as quantitative clonal assays so that results are directly comparable to those obtained in mutagenesis assays. The relationship of the anchorage-independent phenotype to tumorigenicity is currently under intensive investigation.

6629 (CONF-8205230—Summ., pp 94-95) **Transformation of epithelial cells.** Yuspa, S.H. (National Cancer Inst., Bethesda, MD). Sep 1983. NTIS, PC A09/MF A01.

From Conference on establishment of a bioassay system for cancer risk assessment in energy technology; Baltimore, MD, USA (3 May 1982).

The transformatoin of epithelial cells in vitro has been slow to develop but is an essential research area in chemical carcinogenesis. Virtually all scientists working in the area of epithelial transformation have established rigorous goals for optimizing culture systems. Maintenance of functional (differentiative or secretory) competence is an important goal as is maintenance of metabolic competence for carcinogen activation. It is desirable to have a short assay time and for the systems to be quantitative. This has resulted in the search for and development of selection protocols to provide recognition for early transformants and to enhance their growth. A significant problem has been the development of specific markers for transformation. Most laboratories have utilized selection markers since specific phenotypic changes often are present only very late in the transformation of epithelial cells. Thus, many of the models used are studying a preneoplastic event.

6630 (CONF-8205230—Summ., pp 104-112) **Human cell transformation studies with emphasis on epithelial cells.** Smith, H.S. (Peralta Cancer Research Inst., Oakland, CA). Sep 1983. NTIS, PC A09/MF A01.

From Conference on establishment of a bioassay system for cancer risk assessment in energy technology; Baltimore, MD, USA (3 May 1982).

A fundamental prerequisite for understanding the progression to malignancy of any human tissue is the ability to isolate, culture and identify the particular cell type involved regardless of its stage in malignant progression. There are currently numerous well-characterized human cells lines derived from primary and metastatic cancer lesions. Cell lines develop from only a small percentage of tumor specimens. Cell lines may represent one pathway to malignancy wherein the cells gain the ability to grow continuously in culture using currently existing techniques and media. In order to understand the other 90 to 95% of the cells of any given type of cancer, we must develop new techniques that allow us to culture all cancers as well as nonmalignant specimens from that tissue. Within a single primary carcinoma specimen, there may be some cells that have progressed only to the premalignant state, other cells that are also invasive into the surrounding stroma, and perhaps only small subpopulations capable of the complete process of homing to and growth at another organ site.

6631 (CONF-8205230—Summ., pp 128-131) **Speculations on mechanisms of multistage hepatocarcinogenesis: models for promotion and initiation.** Peraino, C. (Argonne National Lab. IL). Sep 1983. NTIS, PC A09/MF A01.

From Conference on establishment of a bioassay system for cancer risk assessment in energy technology; Baltimore, MD, USA (3 May 1982).

Two alternate initiation-promotion models encompassed within the multistage carcinogenesis hypothesis are critically discussed. In Model I initiation is seen to produce phenotypically altered cells that acquire a selective growth advantage through promoter action. In Model II initiation is seen to be restricted to the creation of a tumorigenic molecular lesion; initiated cells are phenotypically normal until stimulated to express their altered phenotypes and neoplastic potential through promoter action. Although Model I currently dominates considerations of hepatic tumorigenesis mechanisms, we believe that the weight of evidence accumulating from recent in vivo studies of skin and liver tumorigenesis, and from in vitro initiation-promotion experiments, would appear to necessitate a re-evaluation of this position. The basis for this viewpoint derives from an evaluation of the degree to which the foregoing predictions generated by each of the models coincides with existing experimental evidence.

6632 (INIS-BR—78, pp 35) **Interaction of a stearic acid paramagnetic derivative (I sub(5,10)) with erythrocytes treated with dipyridamol.** Meirelles, N.C.; Tabak, M. (Universidade Estadual de Campinas (Brazil). Dept. de Bioquimica; Sao Paulo Univ., Sao Carlos (Brazil). Inst. de Fisica e Quimica). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

6633 (INIS-mf—8591, pp 65) **Effect of some plant growth regulators on the photosynthetic activity of isolated chloroplasts.** Dilova, M. (Bylgarska Akademiya na Naukite, Sofia. Inst. po Fiziologiya na Rasteniyata). Oct 1981. (In Russian). NTIS (US Sales Only), PC A07/MF A01. (CONF-8110297—Summ.).

From 3. symposium on plant growth regulators; Varna, Bulgaria (18 Oct 1981).

5504 Genetics

REFER ALSO TO CITATION(S) 6612, 6616, 6689

6634 (INIS-mf—8591, pp 8) **Modulation of genetic expression in plants by gibberellic acid.** Wasilevska, L.; Bralczyk, J.; Mazurkiewicz, J. (Polska Akademia Nauk, Warsaw. Inst. Biochemii i Biofizyki). Oct 1981. NTIS (US Sales Only), PC A07/MF A01. (CONF-8110297—Summ.).

From 3. symposium on plant growth regulators; Varna, Bulgaria (18 Oct 1981).

6635 **The primary structure of genetic variants of mouse hemoglobin.** Popp, R.A. (Oak Ridge National Lab., TN); Bailiff, E.G.; Skow, L.C.; Whitney, J.B. III. *Biochemical Genetics;* **20**: No. 1, 199-208(1982). Contract W-7405-ENG-26.

The primary structures of the α globins from CE/J, DBA/2J, and a stock of Potter's mice were determined to identify the amino acid substitutions associated with the unique isoelectric focusing patterns of these hemoglobins. In addition, the primary structures of the α globins from MOL III and PERU mice were studied in search of amino acid substitutions that may not be detected by isoelectric focusing. CE/J hemoglobin contains a unique kind of α globin called chain 5. It differs from the single kind of α globin (chain 1) in C57BL/6 by having alanine rather than glycine at position 78. DBA/2J hemoglobin has two kinds of α globins: one half is like chain 5 and the other half is like chain 1. The hemoglobin from Potter's stock of Mus musculus molossinus also contains chains 1 and 5, but they are expressed at different levels (i.e., 80% chain 1 and 20% chain 5). MOL III hemoglobin has a single kind of α globin identical to that in C57BL/6, and PERU hemoglobin contains approximately 40% chain 1 and 60% chain 4. Chains 1 and 4 have different amino acids at positions 25, 62, and 68. These studies confirm that mouse hemoglobins separable by isoelectric focusing, but not by other means of electrophoresis, have substitutions of neutrally charged amino acids in their α chains.

6636 **Photoreactivation in two closely related marine fishes having different longevities.** Regan, J.D. (Oak Ridge National Lab, TN); Carrier, W.L.; Samet, C.; Olla, B.L. *Mechanisms of Ageing and Development;* **18**: 59-66(1982). Contract W-7405-ENG-26.

The tautog, Tautoga onitis, and cunner, Tautogolabrus adspersus, are marine fishes which are closely related taxonomically (family Labridae), have similar habits, the same ecological requirements and are found in the same areas. However, they differ markedly in their longevity. The tautog is longer-lived, reaching an estimated average age of 34 years. It attains sexual maturity at 3-4 years of age. The cunner, on the other hand, lives to about 5-6 years of age and is sexually mature at about one year. An examination of their respective capacities for photoreactivation using cells in tissue culture derived from these fishes revealed marked differences in the rate of monomerization of ultraviolet-induced pyrimidine dimers from their DNA. Radiochromatographic analysis of dimers in the tautog showed that half the dimers were removed within a period of 10 min of exposure to photoreactivating light whereas a 50-min exposure was required to photoreactivate dimers to this same level in the cunner. Dark repair of dimers was measured by radiochromatography and by endonuclease assay. The two methods showed similar low levels of excision repair in both species.

5505 Metabolism

REFER ALSO TO CITATION(S) 6684

6637 (INIS-mf—8591, pp 85) **Restoration of the photosynthetic activity and ^{14}C metabolism after magnesium starvation by magnesium and some growth regulators.** Chichev, P.; Stoyanov, I.; Yordanov, I. (Bylgarska Akademiya na Naukite, Sofia. Inst. po Fiziologiya na Rasteniyata). Oct 1981. NTIS (US Sales Only), PC A07/MF A01. (CONF-8110297—Summ.).

From 3. symposium on plant growth regulators; Varna, Bulgaria (18 Oct 1981).

6638 (INIS-mf—8591, pp 101) **Metabolism of itaconic acid in tomatoes.** Gradinarsky, L.; Kolbe, A.; Stock, M.; Schutte, R. (Inst. of Plant Biochem. Acad. of Scien. of GDR, GDR-4a2 Halle (Saale)). Oct 1981. NTIS (US Sales Only), PC A07/MF A01. (CONF-8110297—Summ.).

From 3. symposium on plant growth regulators; Varna, Bulgaria (18 Oct 1981).

6639 (INIS-mf—8591, pp 105) **Effect of picloram on RNA metabolism.** Mikhno, A.; Kalinin, F.; Minakova, S. (Inst. of Plant Phys. USSR, Kiev, USSR). Oct 1981. (In Russian). NTIS (US Sales Only), PC A07/MF A01. (CONF-8110297—Summ.).

From 3. symposium on plant growth regulators; Varna, Bulgaria (18 Oct 1981).

6640 **(INIS-mf—8591) 3. Symposium on plant growth regulators.** (Bylgarska Akademiya na Naukite, Sofia. Inst. po Fiziologiya na Rasteniyata). Oct 1981. 126p. (CONF-8110297—Summ.). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84780040.

From 3. symposium on plant growth regulators; Varna, Bulgaria (18 Oct 1981).

Individual items in scope for the data base are processed separately.

5506 Medicine

REFER ALSO TO CITATION(S) 6336, 6694

6641 (CONF-8205230—Summ., pp 89-90) **Immunological detection and quantification of DNA components structurally modified by alkylating carcinogens, mutagens and chemotherapeutic agents.** Rajewsky, M.F. (Univ. Essen, West Germany). Sep 1983. NTIS, PC A09/MF A01.

From Conference on establishment of a bioassay system for cancer risk assessment in energy technology; Baltimore, MD, USA (3 May 1982).

The detection and quantification of defined reaction products of chemical mutagens and carcinogens (and of many cancer chemotherapeutic agents) with DNA require highly sensitive analytical techniques. The exceptional capability of immunoglobulins to recognize subtle alterations of molecular structure (especially when monoclonal antibodies are used to maximize specificity), outstanding sensitivity of immunoanalysis by high-affinity antibodies, and the fact that radioactively-labelled agents are not required suggest the utility of a radioimmunoassay to recognize and quantitate alkylated DNA products. We have recently developed a set of high-affinity monoclonal antibodies (secreted by mouse x mouse as well as by rat x rat hybridomas; antibody affinity constants, 10^9 to $> 10^{10}$ lmol) specifically directed against several DNA alkylation products with possible relevance in relation to both mutagenesis and malignant transformation of mammalian cells. These alkylation products include O^6-N-butyldeoxyguanosine, and O^4-ethyldeoxythymidine. When used in a radioimmunassay, an antibody specific for O^6-ethyldeoxyguanosine, for example, will detect this product at an O^6-ethyldeoxyguanosine/deoxyguanosine molar ratio of $\sim 3 \times 10^{-7}$ in a hydrolysate of 100 ug of DNA. The limit of detection can be lowered further if the respective alkyldeoxynucleosides are separated by HPLC from the DNA hydrolysate prior to the RIA. The anti-alkyldeoxynucleoside monoclonal antibodies can also be used to visualize, by immunostaining and fluorescence microscopy combined with electronic image intensification, specific alkylation products in the nuclear DNA of individual cells, and to localize structurally modified bases in double-stranded DNA molecules by transmission electron microscopy.

6642 **(DOE/ER/60144—T1) International symposium on single-photon ultra short-lived radionulcides, May 9-10, 1983. Executive summary.** (American Coll. of Nuclear Physicians, Washington, DC). 1983. Contract FG01-83ER60144. 18p. NTIS, PC A02/MF A01. Order Number DE84003985.

Since rubidium-81 has a half-life of 4.6 hours, osmium-191 of 16 days, and mercury-195m of 41.6 hours, the general utilization of daughters of these radionuclides is limited by the half-lives of the parents. There is the problem for centers to buy rubidium-81 every day. For osmium-191, it should be possible to purchase or manufacture a new generator every week or two. The 41.6-hour half-life of mercury 195-m is favorable so that generator can be transported and used for 3 to 4 days. Recent investigations concerning the advantages and disadvantages of use of these very short-lived radionuclides in nuclear medicine are discussed with respect to dosimetry, utility of the radionuclide generators, and dose-sparing. Studies employing these radionuclides in evaluation of respiratory cardiovascular and central nervous system diseases are critically evaluated.

6643 **(INIS-mf—8239) Significance of bone scintiscanning in orthopedics. Attempt of an evaluation with regard to the diagnostical value of bone scintiscanning in connection with other clinical parameters, illustrated by the example of the Orthopedic and Physical Therapeutic Department of the Staedtische Rudolf-Virchow-Krankenhaus Berlin (1976-1979).** Sperling, J. (Freie Univ. Berlin (Germany, F.R.). Fachbereich Humanmedizin). 20 Feb 1981. 108p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83704631.

Thesis.

Bone scintiscanning is a method applied for detecting zones of increased osseous metabolism. Not the focus itself but only the reactive transformation processes are imaged. Therefore it is not possible to give differential diagnostic statements exclusively on the basis of a positive scintigram: the evaluation can only be provided together with the clinical and roentgenological findings. Even though the detection of osseous metastases is the domaine of bone scintiscanning, it was possible to prove on the basis of scintigrams made with 99m-Tc-phosphor compounds in 153 patients that in certain cases this method can be a valuable and informative supplement to diagnosis and therapy when the diagnosis is established carefully.

6644 **(INIS-mf—8240) Results of radiotherapy of carcinomas of the collum and corpus uteri using the 35 MeV betatron during the years 1963 to 1974 with regard to preceding therapy and surgery.** Schuetz-Stendel, P.; Schuetz, W. (Freie Univ. Berlin (Germany, F.R.). Fachbereich Humanmedizin). 22 Jul 1981. 135p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83704634.

Thesis.

The documents of 882 patients with carcinomas of the collum and of 263 patients with carcinomas of the corpus uteri were analysed. As criteria for the success of therapy, the following factors were compiled in tables and were explained afterwards: total survival time, survival time according to defined preset conditions, their change due to the influences provoked by recidivations, early and delayed complications occurring according to various criteria, course of disease according to defined preset conditions and dependency of the localisation of tumour recidivations on the amount of radium content. Then the therapy is assessed on the basis of contrasting the own findings with the results of other authors under the consideration of special aspects.

6645 **(INIS-mf—8241) Radioimmunoassay of renin in human renal tissues. Methodic and diagnostic studies.** Wowra, B. (Tuebingen Univ. (Germany, F.R.). Medizinische Fakultaet). 1981. 68p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704629.

Thesis.

A method has been developed to quantitatively determine renin in human kidney tissue. The angiotensin I split off angiotensinogs by renin was radioimmunologically determined. The renin-renin substrate reaction rate followed a saturation kinetics, as it increased the larger the substrate content in the incubation medium until it acquired a maximum value; the reaction rate decreased with substrate concentrations over 40 mg/ml incubation medium. The discontinuance of the renin reaction after incubation by adding acid, boiling and neutralizing again, gave highest renin values. The RIA scattering was 8.3% for double determination of the same sample, for the determination in different RIA additions 7.0%. The detection limit was 20 pg angiotensin I. A direct comparison of radioimmunoassay and bioassay exhibited a very significant agreement of both methods, where the radioimmunologically measured renin values were on average four times larger than those obtained using biological technique. The definition of the so-called normal values for absolute and specific renin concentration in human kidney tissue enabled one to assess the renin values in various syndromes.

6646 **(INIS-mf—8242) Possible quantification of cardiac function in the framework of first pass radionuclide technique using a single crystal gamma camera.** Knesewitsch, P. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin). 28 Jan 1982. 131p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83704632.

Thesis.

Non-invasive methods have been developed permitting beyond the known possibilities to evaluate global ejection fractions and the segmental wall motion of the left cardiac ventricle, to assess the end-diastolic and end-systolic volumes, the regional ejection fractions and the akinetic segment in % in the framework of the first pass radionuclide technique. Determination of the end-diastolic value of the left ventricle was carried out with the aid of a gamma camera equiped with a converging collimator by previous calibration of the system to a volume phantom. The calculation of the end-diastolic volume is done roughly on the basis of the length-diameter method according to Arvidson. The result turned out to be well in accordance with the results obtained by kineventricular recording. Prior to the calculation of the regional ejection fraction from the end-diastolic and systolic images, a realistic, "parabolic" background correction was carried out. By means of the region-of-interest technique five regions were defined in an end-diastolic/end-systolic difference chart and their regional ejection fractions calculated. It was found that the regional ejection fraction is a quantity providing ample information on the regional performance capacity of the left ventricle. Regional ejection fractions express regional pump functions of the left ventricle and, being three-dimensional (i.e., volume-related) parameters, are superior to the one and two-dimensional measuring values (semiaxis shortenings, visual asynergism evaluation). The first pass technique thus provides methods allowing a detailed diagnosis of the functional capacity of the left ventricle, combined with a minimum of hazards to the patients. A list of different work groups in table form shows that nuclear-medical methods can be used as routine measures for cardiac function diagnosis.

6647 **(INIS-mf—8244) ^{201}Tl in myocardial diagnosis: studies on the influence of dipyridamole, dobutamine ergometer exercise and background subtraction on the ^{201}Tl myocardial scintiscan.** Seiderer, M. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin). 18 Dec 1979. 141p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83704633.

Thesis.

Changes in ^{201}Tl myocardial scintiscans upon administration of dipyridamole or dobutamine and upon ergometer exercise relative to scintiscans at rest were investigated as well as the influence of myocardial background subtraction on scintiscan quality and information. A total of 90 ^{201}Tl examinations were carried out in 59 patients. 18 patients had no myocardial disease, 30 patients had a coronary disease, 5 patients suffered from cardiomyopathy and 6 from left ventricular hypertrophy. The findings are discussed in detail.

6648 **(INIS-mf—8582) Right and left ventricular ejection fraction at rest and during exercise assessed with radionuclide angiocardiography.** Dahlstroem, J.A. (Lund Univ. (Sweden)). 19 May 1982. 116p. (In Swedish). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83703928.

Right (RVEF) and left ventricular ejection fraction (LVEF) assessed with radionuclide angiocardiography were compared to simultaneously obtained catheterization results at rest and during exercise in patients with pulmonary hypertension and ischemic heart disease. Blood pool imaging was performed with red blood cells (RBC) labelled with ^{99}Tcsup(m) in vivo as this method gave more stable ^{99}Tcsup(m) levels in blood compared to ^{99}Tcsup(m)-labelled human serum albumin and because it was more convenient than labelling RBC in vitro. RVEF measured with first pass (FP) technique and equilibrium (EQ) technique correlated well at rest, r = 0.86, and during exercise, r = 0.91. The FP technique had the best reproducibility and reference values at rest were 49+-5 per cent increasing with exercise. When ^{99}Tcsup(m) and ^{133}Xe were compared to assess RVEF with FP technique, the correlation was good, r = 0.88. LVEF assessed with EQ technique and a fixed end-diastolic region of interest was very reproducible at rest and during exercise; reference values at rest were 56+-8 per cent increasing with exercise. In 10 patients with pulmonary hypertension significant negative correlations were found between RVEF assessed with FP technique and pressures in pulmonary artery and right atrium. Abnormal RVEF was found in all patients with right ventricular disfunction. In 22 patients with recent myocardial infarction measurements of LVEF detected left ventricular disfunction better than did measurement of pulmonary artery diastolic pressure. During effort angina in another 10 patients all had abnormal LVEF and abnormal hemodynamics. By combining ejection fraction and stroke volume, ventricular volumes were calculated at rest and during exercise. (author).

6649 **(N—8327573) Effect of decimeter waves on functional state of cardiovascular system, some biochemical and immunological parameters of patients recovering from myocardial infarction.** Sorokina, Y.I.; Poshkus, N.B.; Tupitsina, Y.Y.; Volkova, L.P.; Shubina, A.V.; Krasnikov, V.Y. (Joint Publications Research Service, Arlington, VA (USA)). Jun 1983. 5p. NTIS, PC A03.

In USSR report: Life Sci. Effects of Nonionizing Electromagnetic Radiation, No. 9 (JPRS-83601) p 1-5 (SEE N83-27572 16-51). Translated from Vopr. Kurortol. Fizioter. Lech. Fiz. Kult. (Moscow); No. 2, 9-13(Mar-Apr 1982).

Optimum localization of decimeter wave (DMW) treatment and its intensity was determined to investigate the effect of DMW on functional state of the cardiovascular system, and clinical biochemical parameters of patients with myocardial infarction in the early posthospitalization period. It is assumed that the effect of

DMW via the segmented autonomic system leads to marked changes in the systems. With delivery of treatment to the DI-DV region, the effect on the heart occurs first through the autonomic nervous system which is shown by its vagotropic effect.

6650 **Mucosal structure and radon in head carcinoma dosimetry.** Schlenker, R.A. (Center for Human Radiobiology, Argonne National Laboratory, IL). *Health Physics;* **44**: No. 5, 556-562(May 1983).

(1) The location of the epithelial cells implied by ICRP Publication 26 is incorrect. It leads to dose rates from bone and to dose rate ratios which are much too high. (2) Epithelial thickness has little effect on the ratio of dose rates. (3) The dose rate ratio is strongly dependent on the thickness of the lamina propria and would depend strongly on the thickness of the cytoplasm layer if direct nuclear hits were required for cell transformation. (4) Based on the limited data available for lamina propria and epithelial thicknesses, the airspaces would probably be the dominant source of dose in the mastoid air cells if the ratio of radioactivity levels in bone and airspace were no more than 1 l./g. This would be true whether targets were spread throughout the whole cell or confined to the nucleus alone. (5) The airspaces would probably be the dominant source of dose in the paranasal sinuses if the ratio of radioactivity levels were no more than 1 l./g. and targets were spread throughout the cell. If targets were confined to the nucleus, no conclusion could be drawn due to the lack of information on the thickness of the nucleus-free region of cytoplasm. (6) Four quantities require further study for a better understanding of the importance of radon: (a) the airspace radon concentration, (b) the specific activity of bone adjacent to the mucous membrane, (c) the thickness of the nucleus-free region of cytoplasm, and (d) the thickness of the lamina propria.

6651 **Determination of total body carbon in human subjects by measurement of neutron inelastic scatter gamma rays.** Kyere, A.W.K. Leeds, England; Leeds University (1982). 299p. British Library, Boston Spa, Wetherby, West Yorks. No. D44348/83.

Thesis.

A technique is described for measuring total body carbon directly in living human subjects. The method is based on the detection of the 4.43 MeV inelastic scatter gamma rays promptly emitted from carbon nuclei when the body is irradiated with fast neutrons. The supine subject is exposed bilaterally to a horizontally collimated beam of 14 MeV neutrons and the emitted gamma rays are counted by a shielded NaI(Tl) detector placed underneath the subject. During the total irradiation time of 30 minutes, a total dose equivalent of 2 mSv is given to the subject. The method has been calibrated for sizes of subjects from 30 to 90 kg and of heights between 1.2 and 1.8 m. A new model for estimating total body fat, based on the measurement of both total body carbon and nitrogen has been presented. Body fat, using the new model, was estimated in seven healthy volunteers and nine patients who had undergone major surgery. The fat estimated from this model compared favourably with current methods of skinfold measurement. Because carbon is the major store of energy in the body, the technique is proposed as a method of estimating long-term energy expenditure.

6652 **Experimentelle Mikroangiographie der zerebralen Durchblutung nach lokalem Kaeltetrauma. (Experimental microangiography for measuring cerebral blood circulation following local cold stroke).** Ruttmann, G. Freiburg, Germany, F.R.; Freiburg Universitaet (1982). 57p. (In German). Library of Freiburg Univ. (Germany, F.R.).

Thesis.

In 54 female Wistar rats the exposed brain was right-parietally traumatised; cerebral perfusion of two anatomically different brain sections was angiographically imaged and densitometrically evaluated at various instants. The observation period ranged between 1 and 168 hours after the local cold stroke had been applied. Whereas in the telencephal section situated beyond the direct zone of lesion a maximum perfusion difference between the two hemispheres occurred already 1 hour after the animal had been traumatised, a maximum of perfusion difference was observed 6 hours after traumatisation in the diencephalic section situated directly across the site of the cold lesion. Within the first posttraumatic hours the total cerebral perfusion rapidly decreased. The minimum was reached 24 hours after traumatisation. Then it increased again and on the 7th posttraumatic day the perfusion level reached that of the control group. The tendencies of perfusion behaviour differing from one another, which were observed in both hemispheres, followed the course of the total perfusion. The decrease of perfusion occurring during the first hours after traumatisation is provoked by the compressive effect due to the expanding edema. This is principally indicated by the acute hyperperfusion during the first hours to be observed in the telencephalic section. The different velocities at which the hemispheres recover in the diencephalic section must be attributed to metabolic and hypoxic components. The incomplete recovery of perfusion in the injured hemisphere after 7 days may be due to the glial reaction.

6653 **Das 201-Thallium-Belastungs-Szintigramm bei Koronar-Patienten nach Verarbreichung des kardioselektiven Betablockers Atenolol. (201 thallium scintiscanning during exercise in patients with coronary diseases following administration of the cardioselective beta-blocker atenolol).** Chlup, J. Hannover, Germany, F.R.; Medizinische Hochschule (1982). 15p. (In German). Library of Medizinische Hochschule Hannover (Germany, F.R.).

Thesis.

Changes of regional myocardial perfusion before and after administration of Atenolol (AT) (5 mg i.v.) were investigated by 201-Tl stress-imaging in 14 patients (PAT) with >= 70% coronary obstructions. Scintigrams were performed in 4 projections; scintigraphic defects (SD) in one of the six LV segments had to be identified in at least 2 projections and to show a decrease of activity >= 25%. All PAT had at least one reversible SD. Results: After AT, stress-induced SDs were unchanged in 11 of the 14 PAT at identical work loads (131 Watt). The total number of reversible defects was 33 before and 28 after AT (n.s.). However, not only the 3 PAT with improved stress scintigrams, but also 6 of the 11 PAT with unchanged abnormal stress scintigrams were clinically improved (ECG normalized, no angina). Thus in almost half of the patients (6/14), the stress ECG was normalized without normalisation of perfusion pattern of thallium scintigrams. We conclude that in these patients subendocardial perfusion was enough improved to meet the reduced metabolic needs but not enough to normalise stress images.

6654 **Klinische und roentgenologische Verlaufsbeobachtung bei operierten und nicht operierten Patienten mit Vorhofseptumdefekt. (Clinical and radiological course control of patients with deficiency of the atrial system, having undergone surgery or not).** Herbers, C. Freiburg, Germany, F.R.; Freiburg Universitaet (1981). 145p. (In German). Library of Freiburg Univ. (Germany, F.R.).

Thesis.

In order to establish a follow-up control examination the results of 52 patients and additional data of previous examinations documented in the hospital histology documents were subjected to analysis. The size of the heart is age-dependent: not only in patients who underwent an operation, but also in those who did not. It was found that older patients provide a larger heart volume. In patients who were not operated on, dyspnoea on exertion is observed more frequently. Also cyanosis occurs more often in patients who did not undergo an operation. In both patient groups the second heart sound is split; an operation does not lead to a definite result or effect. Postoperatively the systolic sound can be observed in notably less cases in the phonocardiogram than in that of patients without surgical intervention. In patients who underwent an operation, the absolute heart volume directly decreases postoperatively and in the further course it increases to the preoperative value. The relative heart volume decreases postoperatively but does not increase again. In those patients without surgery the volume increases during the observation period. The accentuation of the right atrium remains more or less unaltered, in patients without surgical intervention. In the patients who underwent an operation, the findings improved in some cases, in a few others no improvement or change could be observed. The same findings were made on the right ventricle, the pulmonary arc and on the pattern of the pulmonary vessels. In both groups performance abilities were improved. The volume performance quotient instantly decreases after surgical intervention.

6655 **Depotfettbestimmung durch Messung von Hautfalten, Koerperumfaengen, Koerperabstaenden sowie durch die K^{40}-Methode bei Kindern. (Determination of depot fat of children by measuring skin folds, body circumference and body distances as well as by the ^{40}K-method).** Kozok, R. Bonn, Germany, F.R.; Bonn Universitaet (1981). 81p. (In German). Library of Bonn Univ. (Germany, F.R.).

Thesis.

10 different anthropometric measurements were performed in 134 children (mean age 3 years). We measured at 4 sites the thickness of four skin folds. In addition six body distances and circumferences were determined by means of a measuring tape. By multiple linear regression analysis those values were calculated, which representatively indicate the total fat content. Simultaneously a second depot fat determination was performed on these children by means of the ^{40}K method. Here, the total potassium content was determined by measuring the natural ^{40}K radioactivity of the whole body. The comparison of these two fat values showed good correlation. Our results confirm the opinion of those authors, who also evaluated the significance of this method. The measurement of the subcutaneous fatty tissue by means of anthropometric methods permits the objective analysis and evaluation of the outer state of nutrition of children.

6656 **Zur primaeren Strahlentherapie des Carcinoma corporis uteri an der Universitaetsfrauenklinik Freiburg i.Br. 1964-1977. (Primary radiotherapy of carcinoma corporis uteri in the University Hospital of Freiburg i.Br. during 1964 to 1977. Results of therapy and experiences following introduction of telecobalt therapy).** Zeller, G. Freiburg, Germany, F.R.; Freiburg Universitaet (1981). 78p. (In German). Library of Freiburg Univ. (Germany, F.R.).

Thesis.

The present study reports about the examination of 463 patients. Within the period comprised by the report, a significant shift of the age-structure to the senium was found. The details of the radium- and telecobalt therapy and the results of therapy achieved in the total patient material, the individual age-groups and stages are described. The survival rates for the period until 31.12.1978 are 60.5% for the survival rate of 3 years; for the survival rate of 5 years 53.5% and for the survival rate of 10 years 34.3%. The question if the increase of the focal telecobalt dose in 1970 by 10 (from 30 to 40%) induced an improvement of the results, cannot be answered unequivocally. An intrauterine dosage of radium of approximately 5000 mgelh seems to provide relatively favourable results with regard to survival time and local recidivation and complication rates. A vaginal recidivation occurred in 2.3% of the cases in which a vaginal radium cylinder was applied; without the cylinder it occurred in 2.6%. With regard to the therapeutically induced delayed consequences a close correlation was found between the proctitis rate and the dose of intravaginal radium prophylaxis. Due to the fact that this does not significantly influence the vaginal recidivation rate, it should be weighed if it were better to no longer use the vaginal cylinder, particularly with patients being in stage I. The dependency of the intestinal disturbances - as delayed irradiation lesions - on the amount of the telecobalt doses is striking. When comparing these results with those found between 1953 and 1963 in primarily irradiated patients suffering from a carcinoma of the corpus uteri, it results that the five-year survival rate was improved by 39% to 53.5%, that the local or vaginal recidivation rate was reduced and that the incidence of complications was slightly reduced.

6657 **Radioimmunologische Untersuchungen ueber das Vorkommen von Serumantikoerpern mit B-Streptokokken-Spezifitaet bei Schwangeren und Saeuglingen. (Radioimmunoassay of serum antibodies with B-streptococcus specificity in pregnant women and infants).** Frey, C.W. Bonn, Germany, F.R.; Bonn Universitaet (1980). 89p. (In German). Library of Bonn Univ. (Germany, F.R.).

Thesis.

In a specific competitive radioimmunoassay of purified rabbit antibodies, labeled with iodine 125 against group- and type-antigens of streptococcus agalactiae (streptococci type B), we investigated the amount of serum anti-bodies providing specificity of streptococci type B in not preselected pregnant women, newborn and babies with colonies of streptococci type B or with diseases due to streptococci type B and in some of their mothers. These antibodies could be detected in 26 of 45 pregnant women and in 3 of 7 children with colonies of streptococci type B. 5 of 18 newborn with the "early-onset" type of infection and 6 of 7 of their mothers provided antibodies with specificity of streptococci type B as did one of two newborn with the "late onset" type of infection. Contrary to the supposition of Baker and Kasper and in accordance with the findings of Wilkinson, the "risk group" cannot be determined only by detecting the antibodies against streptococci type B. The risk group comprises those persons in whom the colonisation of streptococci agalactiae leads to the frequently life-threatening infecton of neonatals with streptococci type B.

6658 **Behandlungsergebnisse bei der postoperativen Telekobalt-Bestrahlung des Kollum- und Korpuskarzinoms. (Results of post-surgical telecobalt radiotherapy of carcinomas of the collum and corpus uteri).** Shamaa, H. Hamburg, Germany, F.R.; Hamburg Universitaet (1980). 83p. (In German). Library of Hamburg Univ. (Germany, F.R.).

Thesis.

Between 1965 and 1975 132 patients suffering from carcinomas of the collum uteri and 124 patients with carcinomas of the corpus received post-surgical telecobalt treatment. The small pelvis was exposed to stationary irradiation (3500 R DH in the abdomen at field dimensions 18 x 6 cm) combined with biaxial perpendicular irradiation (at an angle of 160°, the daily radiation dose was 350 R moving over one axis, with a focal dose fo 2500 R HD). Thus the total focal dose amounted to 6000 R. As this field covered the vagina as far as up to its central third, local radium insertion at the stub of the vagina could be dispensed with. Follow-up after 5 years proved the absence of growths in 80,76% of patients with carcinoma of the collum uteri stage I and 62,5% with stage II. Corpus carcinoma patients were free of growth after 5 years at a rate of 68,0%. Among collum carcinoma patients 1,5% and among corpus carcinoma patients 2,4% were found with isolated vaginal stub recidivations.

6659 **Das autonome Adenom der Schilddruese. Untersuchungen ueber Beziehungen zwischen szintigraphischer Darstellung und Stoffwechselfunktion. (Autonomous adenomas of the thyroid. Studies of the relationships between scintigrams and metabolic functions).** Weidel, C.K. Bonn, Germany, F.R.; Bonn Universitaet (1979). 59p. (In German). Library of Bonn Univ. (Germany, F.R.).

Thesis.

The details of the relations existing between the scintigram of the autonomous adenoma and its metabolic function are still unknown. Therefore the author tried to detect these relationships on the basis of the findings of 98 patients with confirmed autonomous adenomas. The following statements result: 1. The clinical symptoms and signs cannot be used for assessing the degree of scintigraphic decompensation and the metabolic conditions. 2. A significant graduation of the thyroxine values found for the serum exists between the different scintigraphic degrees of decompensation. 3. The TRH test is negative in all patients with decompensated autonomous adenomas and in the majority of the patients with compensated autonomous adenomas. 4. With the autonomous adenoma there is a direct relation between the patient's age, the size of the adenoma and the level of the thyroxine concentrations. From this consequences result for the practice, which are also discussed in the study.

5507 Microbiology

REFER ALSO TO CITATION(S) 6612, 6697

6660 **Death of a hadal deep-sea bacterium after decompression.** Yayanos, A.A.; Dietz, A.S. (Univ. of California, San Diego). *Science (Washington, D.C.);* **220**: 497-498(Apr 1983).

An obligately barophilic bacterium that was recovered from a depth of 10746 meters in the Pacific Ocean slowly lost colony-forming ability (assayed at 101.3 megapascals and 2 degrees C) during incubation at atmospheric pressure and 0 degrees C.

5508 Morphology

REFER ALSO TO CITATION(S) 6615, 6628

5509 Pathology

REFER ALSO TO CITATION(S) 6630

6661 (CONF-8205230—Summ., pp 100-103) **Special note on human tissue experimentation.** Trump, B.F. (Univ. of Maryland, Baltimore). Sep 1983. NTIS, PC A09/MF A01.

From Conference on establishment of a bioassay system for cancer risk assessment in energy technology; Baltimore, MD, USA (3 May 1982).

The utilization of human tissues in toxicologic and carcinogenic research is attended by a number of ethical, logistical and economic problems. In the case of surgical resections, uninvolved tissue may be obtained which does not interfere with the diagnosis, i.e., surgical margins. These tissues then may be placed in media such as L-15 and transported at 0 to 4°C to the laboratory. The time of storage in L-15 at 4°C varies with the tissue. The main problem with tissues obtained at surgery is that preneoplastic lesions and initiated sites may or may not exist in the putatively normal tissue. Viability of tissues obtained at the time of autopsy depend on the interval between death of the patient and tissue obtainment as well as on the temperature. At 37°C tissues have various survival times.

5510 Physiological Systems

6662 **Histoautoradiographische Untersuchungen zur Rhythmik der DNS-Synthese in Leber und Niere der Ratte nach 2/3-Teilhepatektomie und Hypophysektomie. (Histoautoradiographic studies of the rhythmicity of DNA biosynthesis in liver and kidneys of rats following a 2/3 partial hepatectomy and hypophysectomy).** Wacker, G. Frankfurt, Germany, F.R.; Frankfurt Universitaet (1980). 63p. (In German). Library of Frankfurt Univ. (Germany, F.R.).

Thesis.

Male Wistar rats were subjected to hypophysectomy and 7 days later to partial hepatectomy. A control group was only hepatectomised. During the test period of 10 days, every day 2 animals were killed one hour after injection of H^3 thymidine. The mitotic index was determined in liver and kidneys, the DNA synthesis rate by histoautoradiography. The following results were obtained: After partial hepatectomy liver and kidneys show a discontinued DNA synthesis with maxima on the first and tenth day (liver) and on the third and tenth day (kidneys). When additionally hypophysectomy is performed, the first synthesis maximum occurs on the second day. This peak is lower and shorter than that occurring after partial hepatectomy. The second peak which is also smaller, already appears on the eighth day. After hypophysectomy has been carried out, no synthesis peaks occur for the kidneys. Here, only a low basic synthesis rate was found. In the discussion the author tries to interpret the influence of hypophysic and other hormones on the regeneration of liver and kidneys.

6663 **Autoradiografische Untersuchungen ueber das Adaptionsverhalten der Mundhoehlenflora gegenueber Xylit. (Autoradiographic studies of the adaptative behaviour of the oral flora to xylit).** Schmidt, R. Hamburg, Germany, F.R.; Hamburg Universitaet (1980). 37p. (In German). Library of Hamburg Univ. (Germany, F.R.).

Thesis.

Fasten saliva samples of 22 test persons were aerobically incubed with radio-labeled xylit and sorbit for 24 hours at 37°C. It was determined by thin-layer chromatography and by the autoradiographic detection of the sugar alcohols, after what incubation time the sugar substitutes were completely metabolised. In order to provide intensive contact between the organisms of the oral cavity and the xylit the test persons rinsed their mouth three times per day with a xylit solution over a period of one month. Then a second saliva sample was examined. By adding the bacteriostaticum chloramphenicol to the cultures, it was proved that in the majority of the test persons the decompensation of xylit and sorbit is enzymatically induced when the organisms living in the oral cavity get into contact with sugar alcohol. Between the decompensation time before and after 30 days of xylit contact no significant difference could be found. These results permit the conclusion that after the contact over one month the organisms of the oral cavity do not adapt to xylit.

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 6599, 6637, 6638

6664 (INIS-mf—8591, pp 7) **Nonindolic auxins and their interaction with cytokinins.** Khvojka, L. (Ceskoslovenska Akademie Ved, Prague. Ustav Experimentalni Botaniky). Oct 1981. (In Russian). NTIS (US Sales Only), PC A07/MF A01. (CONF-8110297—Summ.).

From 3. symposium on plant growth regulators; Varna, Bulgaria (18 Oct 1981).

6665 (INIS-mf—8591, pp 34) **Specificity of gibberellin-o-glucoside (GA-0-GLC) hydrolyzing enzymes from peas.** Schiemann, W. (Akademie der Wissenschaften der DDR, Greifswald. Zentralinstitut fuer Elektronenphysik). Oct 1981. NTIS (US Sales Only), PC A07/MF A01. (CONF-8110297—Summ.).

From 3. symposium on plant growth regulators; Varna, Bulgaria (18 Oct 1981).

6666 (INIS-mf—8591, pp 64) **Effect of IAA and GA_3 ion absorption and distribution in radish plants.** Choluj, D.; Starck, Z. (Warsaw Agricultural University (Poland). Inst. of Plant Biology). Oct 1981. NTIS (US Sales Only), PC A07/MF A01. (CONF-8110297—Summ.).

From 3. symposium on plant growth regulators; Varna, Bulgaria (18 Oct 1981).

6667 (INIS-mf—8591, pp 69) **2,4-D effects on growth and nitrogen metabolism of winter wheat.** Sagi, F.; Lomniczi, H.; Zsoldos, F. (Cereal Res. Unstitute, Szeged and Dept. of Plant Physiol., A. Jozef University, Szeged, Hungary). Oct 1981. NTIS (US Sales Only), PC A07/MF A01. (CONF-8110297—Summ.).

From 3. symposium on plant growth regulators; Varna, Bulgaria (18 Oct 1981).

6668 (INIS-mf—8591, pp 72) **Effect of clorcholinchlorid and kinetin on photosynthetic intensity and ^{14}C distribution in maize leaves under different water-supply conditions.** Dushkova, P.; Minkov, I. (Plovdivski Univ. (Bulgaria)). Oct 1981. (In Russian). NTIS (US Sales Only), PC A07/MF A01. (CONF-8110297—Summ.).

From 3. symposium on plant growth regulators; Varna, Bulgaria (18 Oct 1981).

6669 (INIS-mf—8591, pp 103) **Effect of plant growth regulators on the formation of malic acid in the blossoming period of grapevine and its connection with berry set.** Ildiko, Sz.; Szarvas, M.T.; Jozef Eifert (Res. Inst. of Viticulture and Ecology, Inst. of Izotopes of the Hungarian Academy of Science). Oct 1981. NTIS (US Sales Only), PC A07/MF A01. (CONF-8110297—Summ.).

From 3. symposium on plant growth regulators; Varna, Bulgaria (18 Oct 1981).

6670 **(N—8327313) Assessing solar energy and water use efficiencies in winter wheat.** Asrar, G.; Hipps, L.E.; Kanemasu, E.T. (Kansas State Univ., Manhattan (USA)). Sep 1982. 22p. (E—83-10329; NASA-CR—171659). NTIS, PC A02/MF A01.

The water use and solar energy conversion efficiencies of two cultivars of winter wheat (Triticum aestivum L., vars, Centurk and Newton) planted at three densities, were examined during a growing season. Water use, based on soil moisture depletion, was

the lowest under the light, and the highest under the heavy planting densities of both cultivars. Water use efficiency of medium and heavy planting densities were greater than the light planting densities in both cultivars. The canopy radiation extinction coefficients of both cultivars increased with increases in planting density. Efficiency of operation interception of photosynthetically active radiation by both cultivars improved from the time of jointing until anthesis, and then decreased during senescence. The efficiency of the conversion of intercepted radiation to dry matter (biochemical efficiency) decreased throughout the growing season both cultivars. The interception, biochemical, and photosynthetic efficiencies improved as planting density increased.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 5811, 6597, 6616

6671 **(CONF-830556—3) Germ cell toxicity: significance in genetic and fertility effects of radiation and chemicals.** Oakberg, E.F. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 66p. NTIS, PC A04/MF A01. Order Number DE84003485.

From International workshop on the principles of environmental mutagenesis, carcinogenesis, and teratogenesis; Shanghai, China (25 May 1983).

The response of the male and female to radiation and chemicals is different. Any loss of oocytes in the female cannot be replaced, and if severe enough, will result in a shortening of the reproductive span. In the male, a temporary sterile period may be induced owing to destruction of the differentiating spermatogonia, but the stem cells are the most resistant spermatogonial type, are capable of repopulating the seminiferous epithelium, and fertility usually returns. The response of both the male and female changes with development of the embryonic to the adult gonad, and with differentiation and maturation in the adult. The primordial germ cells, early oocytes, and differentiating spermatogonia of the adult male are unusually sensitive to the cytotoxic action of noxious agents, but each agent elicits a specific response owing to the intricate biochemical and physiological changes associated with development and maturation of the gametes. The relationship of germ cell killing to fertility is direct, and long-term fertility effects can be predicted from histological analysis of the gonads. The relationship to genetic effects, on the other hand, is indirect, and acts primarily by limiting the cell stages available for testing, by affecting the distribution of mitotically active stem cells among the different stages of the mitotic cycle, and thereby, changing both the type and frequency of genetic effects observed. 100 references, 38 figures, 7 tables.

6672 **(DOE/EV/02283—4) Response of a forest ecotone to ionizing radiation. Progress report, April 15, 1983-April 14, 1984.** Murphy, P.G.; Sharitz, R.R. (Michigan State Univ., East Lansing (USA); Savannah River Ecology Lab., Aiken, SC (USA)). Nov 1983. Contract AC02-76EV02283. 29p. NTIS, PC A03/MF A01. Order Number DE84003187.

Compositional and structural characteristics of three forest types, including aspen dominated, maple-birch dominated, and an intervening ecotone (midecotone), were studied before and after irradiation in northern Wisconsin. In all three areas, the density of seedlings at 10 m was greatly reduced within a year following the 1972 radiation event. In the maple-birch area seedlings were virtually absent at 10 m until 1982 and 1983 when their numbers were comparable to preirradiation levels. In the aspen and midecotone areas 1983 seedling densities at 10 m were only 50 and 17%, respectively, of the preirradiation levels. Woody plants of tree stature were eliminated at 10 m in all three areas within two years of irradiation but by 1982 only the aspen area lacked plants in this size class. In 1982 total leaf litter production was 26 and 63% below 1971 preirradiation levels at 10 m in the aspen and maple-birch areas, respectively. But at 10 m in the midecotone, it had increased, relative to 1971, by 27%. The ratio of shrub to tree leaf litter continues to decline as the heavily irradiated zone of all three areas continues to be recolonized by tree species and the canopy at 20 m continues to fill out. Present studeis emphasize the rate at which the three areas continue to be recolonized, and the composition of the recolonizing flora, relative to the preirradiation forest.

6673 **(INIS-mf—8254) Interactions of adriamycin and X-rays in Chinese hamster cells.** Meder, G. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin). 25 Feb 1982. 65p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704626.

Thesis.

The effect of a combined ADM-and-radiation treatment of varying intervals was investigated in vitro. ADM sensitized the cells for the subsequent irradiation. This action was noticeable after 7h as a synergystic and after 2 and 3d as an additive effect of the combination treatment. Obviously, the ADM damage was inherited by the following cell generations. After 7d the sensitization of the cells could no longer be proved. From these results and those of other authors some general conclusions can be drawn. Different cell types react differently to the same kind of treatment. All forms of interaction are noticeable. Moreover, the ADM damage is obviously inherited. It must be assumed that this variability of the phenomena observed in vitro is also found in the human organism.

6674 **(INIS-mf—8256) Subcellular distribution of ^{239}Pu, ^{241}Am and ^{59}Fe in the liver of rat and Chinese hamster as dependent on time.** Suetterlin, U. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Bio- und Geowissenschaften). 23 Jun 1982. 128p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83704628.

Thesis.

The subcellular distribution of monomeric ^{239}Pu, ^{241}Am and iron in rat and Chinese hamster liver has been investigated by sucrose-, metrizamide- and Percoll-density gradients. In rat liver, the transuranium elements become and remain bound to typical lysosomes up to several months after incorporation. Lysosomes are also the primary storage organelle in Chinese hamster liver. However, their apparent density in sucrose decreases with time, which possibly indicates transition into telolysomes. The transuranium nuclides show a subcellular distribution which is quite different from that of iron.

6675 **(INIS-mf—8259) Biochemical studies of the ammonia detoxification in irradiated chicken embryos.** Klockenberg, G. (Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 16 Feb 1981. 73p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704627.

Thesis.

Following whole irradiation of 16-day-old chicken embryos with 770 R, ammonia concentration in blood serum and uric acid concentration in serum and tissue increase distinctly, whereas only a small change in concentration of urine in blood serum and tissue homogenate was noted. Following irradiation glutamic acid concentration in blood serum and glutamine concentration in serum and tissue also increased noticeably. Similarly the content of creatine in blood serum increased as a result of irradiation although no deviation from control values were noted in the tissue. When embryos are irradiated with increasing doses from 420 to 980 R, ammonia concentration in blood serum and also uric acid concentration in blood serum and tissue increase linearly with dose whereas no dose dependence could be observed for the content of urine in blood serum and in tissue. These results show that the increased amounts of ammonia produced upon irradiation are detoxified by the formation of uric acid, glutamic acid and glutamine. Furthermore, elimination of ammonia is also possible through creatine synthesis.

6676 **(INIS-mf—8261, pp 285-291) General report of Technical Committee IV.** Feinendegen, L.E. 1979. (In German). NTIS (US Sales Only), PC A14/MF A01.

In Activities of the Civil Defense Commission of the Federal Ministry of the Interior. Annual report 1979.

During the report period, work in section IV of the Committee was continued on the molecular, cellular and organic levels with the aim to elucidate the origin, course and treatment possibil-

ity of the syndrome that may occur in the mammalian organism upon acute and chronic ionizing irradiation as a function of the radiation dose received. The investigations dealt a.o. with the effect of O_2 in protein radiolysis, recovery processes of the haematopoietic stem cells, delayed effects in the gastrointestical tract subsequent to local irradiation, and combination damage in the lungs and liver of rats upon combined cytostatic and radiation therapy.

6677 (INIS-mf—8585, pp S4) **Effect of UV radiation on DNA synthesis, growth and division of Escherichia coli B/r.** Kucerova, H. (Ceskoslovenska Akademie Ved, Prague. Mikrobiologicky Ustav). [nd]. NTIS (US Sales Only), PC A02/MF A01. (CONF-8010347—Absts.).

From 15. annual meeting of the Czechoslovak Society for Microbiology; Gottwaldov, Czechoslovakia (7 Oct 1980).

6678 (INIS-mf—8591, pp 80) **Influence of gibberellin on radiosensitivity and peroxidase activity in durum wheat mutant.** Filev, K.; Ancheva, M.; Markova, M. (Akademiya na Selskostopanskite Nauki, Sofia (Bulgaria). Inst. po Genetika). Oct 1981. NTIS (US Sales Only), PC A07/MF A01. (CONF-8110297—Summ.).

From 3. symposium on plant growth regulators; Varna, Bulgaria (18 Oct 1981).

6679 (INIS-mf—8591, pp 6) **Movement of auxin pulses through hypocotyls of Helianthus annuus. A mathematical analysis and deduced conclusions.** Hasenstein, K.H.; Kaldewey, H. (Botany Section, University of the Saarland, Saarbruecken (Germany, F.R.)). Oct 1981. NTIS (US Sales Only), PC A07/MF A01. (CONF-8110297—Summ.).

From 3. symposium on plant growth regulators; Varna, Bulgaria (18 Oct 1981).

6680 **(LA-UR—83-3156) Soft x rays as a tool to investigate radiation-sensitive sites in mammalian cells.** Brenner, D.J.; Zaider, M. (Los Alamos National Lab., NM (USA); Columbia Univ., New York (USA). Coll. of Physicians and Surgeons). 1983. Contract W-7405-ENG-36. 9p. (CONF-8310172—6). NTIS, PC A02/MF A01. Order Number DE84003775.

From Advances in soft x-ray science and technology conference; Upton, NY, USA (17 Oct 1983).

It is now clear that the initial geometrical distribution of primary radiation products in irradiated biological matter is fundamental to the observed end point (cell killing, mutation induction, chromosome aberrations, etc.). In recent years much evidence has accumulated indicating that for all radiations, physical quantities averaged over cellular dimensions (micrometers) are not good predictors of biological effect, and that energy-deposition processes at the nanometer level are critical. Thus irradiation of cells with soft x rays whose secondary electrons have ranges of the order of nanometers is a unique tool for investigating different models for predicting the biological effects of radiation. We demonstrate techniques whereby the biological response of the cell and the physical details of the energy deposition processes may be separated or factorized, so that given the response of a cellular system to, say, soft x rays, the response of the cell to any other radiation may be predicted. The special advantages of soft x rays for eliciting this information and also information concerning the geometry of the radiation sensitive structures within the cell are discussed.

6681 **(N—8326407) Male vs. female mediated teratogenesis.** Manson, J.M. (Cincinnati Univ., OH (USA)). Apr 1982. 18p. NTIS, PC A16/MF A01.

Different types of reproductive dysfunction with exposure of males and females during different stages of the reproductive process were correlated. It is a well-established principle that teratogenic exposure of the pregnant female, and thus of the embryo, during the organogenesis period of development can lead to birth defects in the offspring. The outcome of this exposure paradigm, as well as the outcomes associated with exposure during other stages of the reproductive process that have received less experimental attention are discussed. Insult to the germ cells of the male during spermatogenesis and to the female during oogenesis can also lead to reproductive dysfunction. The type of adverse outcome, however, is quite different from that occurring with embryonic exposure during the organogenesis period. An overview of this area will be given with the intent of focusing on those types of reproductive dysfunction that are most relevant to environmental exposure of men and women.

6682 **(N—8326422) USSR report: Space Biology and Aerospace Medicine, volume 17, No. 2, March-April 1983.** Gazenko, O.G. (Joint Publications Research Service, Arlington, VA (USA)). May 1983. 149p. (JPRS—83467). NTIS, PC A07.

Translated from Kosmich. Biol. i Aviakosmich. Med. (Moscow); 17, No. 2, Mar-Apr 1983, 96p.

Space radiation and its hazards to the body are discussed.

6683 **Protection of mice from whole-body gamma radiation by deuteration of drinking water.** Laissue, J.A. (Pathologisches Inst., Luzern, Switzerland); Bally, E.; Joel, D.D.; Slatkin, D.N.; Stoner, R.D. *Radiation Research;* **96**: No. 1, 59-64(Oct 1983).

Drinking water made available to mice was changed from ordinary tap water to tap water containing 30 atom% D_2O when the animals were 6 to 8 weeks old. Twelve days later, the deuterated mice and an approximately equal number of nondeuterated control mice were subjected to whole body γ radiation from a ^{60}Co source. All mice received ordinary tap water after the irradiation. Postirradiation mortality was significantly less in deuterated than in nondeuterated animals. These results may have practical implications for radiotherapy of human malignant tumors.

6684 **Induction of liver tumors by ^{239}Pu citrate of $^{239}PuO_2$ particles in the Chinese hamster.** Brooks, A.L. (Lovelace Inhalation Toxicology Research Inst., Albuquerque, NM); Benjamin, S.A.; Hahn, F.F.; Brownstein, D.G.; Griffith, W.C.; McClellan, R.O. *Radiation Research;* **96**: No. 1, 135-151(Oct 1983). Contract AC04-76EV01013.

The influence of radiation dose distribution on the frequency of ^{239}Pu-induced liver tumors was evaluated in the Chinese hamster. Different concentrations of ^{239}Pu citrate or $^{239}PuO_2$ particles of known sizes were injected intravenously via the jugular vein. About 60% of the injected ^{239}Pu citrate was deposited in the liver and 40% in the bone. The ^{239}Pu citrate was rather uniformly distributed throughout the liver parenchyma. Injected plutonium oxide particles were taken up by the reticuloendothelial system with 90% of the body burden deposited in the liver. The $^{239}PuO_2$ particles were localized in the Kupffer cells and produced nonuniform dose distributions that were dependent on particle size. There was an activity- and dose-dependent increase in the incidence of total liver parenchymal cell tumors following injection with either plutonium particles or citrate. Plutonium citrate also produced hemangiosarcomas of the liver and tumors in bone and bone marrow. The latent period for liver tumor appearance in animals exposed to ^{239}Pu citrate or $^{239}PuO_2$ particles increased as the injected activity decreased. These data indicate that, in Chinese hamster liver, local radiation dose distribution is less important in altering tumor incidence than injected activity or average dose. However, the more uniform irradiation from ^{239}Pu citrate administration was more effective in cancer production than the nonuniform irradiation from $^{239}PuO_2$ particle.

6685 **Response of colony-forming units-spleen to heavy charged particles.** Ainsworth, E.J.; Kelly, L.S.; Mahlmann, L.J.; Schooley, J.C.; Thomas, R.H.; Howard, J.; Alpen, E.L. (Lawrence Berkeley Lab., CA). *Radiation Research;* **96**: No. 1, 180-197(Oct 1983). Contract AC03-76SF00098.

Survival of colony-forming units-spleen (CFU-S) was measured after single doses of photons or heavy charged particles from the BEVALAC. The purposes were to define the radiosensitivity to heavy ions used medically and to evaluate relationships between relative biological effectiveness (RBE) and dose-averaged linear energy transfer (LET/sub Infinity/). In in vitro irradiation experiments, CFU-S suspensions were exposed to 220 kVp X rays or to ^{20}Ne (372 MeV/μm) or ^{40}Ar (447 MeV/μm) particles in the plateau portion of the Bragg curve. In in vivo irradiation experiments, donor mice from which CFU-S were harvested were exposed to

^{12}C (400 MeV/μm), ^{20}Ne (400 or 670 MeV/μm), or ^{40}Ar (570 MeV/μm) particles in Bragg peaks spread to 4 or 10 cm by spiral ridge filters. Based on RBE at 10 survival, the maximum RBE of 2.1 was observed for ^{40}Ar particle characterized by an LET/sub Infinity/ of ~ 100 keV/μm. The responses of CFU-S are compared with responses of other model sytems to heavy charged particles and with the reported sensitivity of CFU-S to neutrons of various energies. Low energy ^{12}C and ^{20}Ne particles have RBEs in the range of values reported for 14.7 MeV neutrons.

6686 **Radiation-induced DNA content variability in mouse sperm.** Pinkel, D.; Gledhill, B.L.; Van Dilla, M.A.; Lake, S.; Wyrobek, A.J. (Lawrence Livermore National Laboratory, Biomedical Sciences Division, University of California, Livermore). *Radiation Research;* **95**: No. 3, 550-565(Sep 1983).

Mouse sperm collected from the cauda epididymidis 35 days after acute testicular X-ray exposure and fluorescently stained for DNA show dose-dependent increases in the coefficient of variation (CV) of flow cytometrically obtained fluorescence distributions. By comparing dose-response curves obtained with three protocols which overcome the optical and cytochemical difficulties of sperm measurement in different ways we conclude the response is due to X-ray-induced DNA content variability. In the range between 0 and 600 rad the dose dependence of the square of CV of the DNA content variability, delta CV2D, is described by delta CV2D ? Bx + Cx2, with 0 less than or equal to B less than or equal to 0.23 X 10(-2) and C ? (0.44 +/- 0.06) X 10(-4). The dose x is measured in rad and delta CVD is expressed in percent. Computer modeling of the shapes of the fluorescence distributions show that at 600 rad 30 to 40% of the sperm have abnormal DNA content. Some have errors as large as two whole chromosomes, but it is not clear whether they are due to whole chromosome nondisjunction or a finer fragmentation of the genome. Exposures to benzo(a)pyrene and mitomycin C cause no detectable DNA content variability. We conclude mouse sperm DNA content measurements are not sensitive to small amounts of aneuploidy and as such will only be useful in detecting agents that produce substantial DNA content variability. Another animal with a smaller number of chromosomes might be more favorable. These sperm measurement techniques may find additional application in other areas of reproductive biology, such as the determination of the relative numbers of X and Y chromosome-bearing sperm in semen that may be artificially enriched in one population.

6687 **Interpretation of cytogenetic damage induced in the germ line of male mice exposed for over 1 year to ^{239}Pu alpha particles, fission neutrons, or ^{60}Co gamma rays.** Grahn, D.; Lee, C.H.; Farrington, B.F. (Division of Biological and Medical Research, Argonne National Laboratory, IL). *Radiation Research;* **95**: No. 3, 566-583(Sep 1983).

The relative biological effectiveness (RBE) of ^{239}Pu alpha particles, fission neutrons (0.85 MeV), and ^{60}Co gamma rays has been evaluated for the induction of reciprocal chromosome translocations in spermatogonia and of chromosome/chromatid fragments and chromatid rearrangements in the primary spermatocyte of adult male B6CF1 mice. Age concurrency was maintained for both internal and external radiations which were delivered at about 1 rad/week for ^{239}Pu (single intravenous dose of 10 microCi/kg), 0.67, 1.67, and 2.67 rad/week for neutrons, and 6.95, 17.4, and 32 rad/week for gamma rays for at least 60 weeks. In terms of frequency of translocations, the response to the alpha emitter was nonlinear (concave downward) with little dose-response predictability; to cumulative neutron exposures the response was linear, without evidence of a dose-rate effect; and to gamma radiation the responses were linear, and a significant dose-rate effect was seen. RBE estimates are variable. For translocations, the n/gamma ratio is between 10 and 24, depending upon weekly dose level, and the ratio is 1 or less for the alpha particle relative to the neutron. For fragments, the n/gamma ratio is 18 to 22, depending upon age factors, and alpha/n is 1.5. For chromatid rearrangements, n/gamma is 7 and alpha/n is essentially indeterminate, but much below one. The overall response to the alpha emitter is interpreted to be a complex function of (a) microdosimetric heterogeneity, (b) a nearly invariant deposition pattern in the gonad, (c) the high sensitivity of differentiating spermatogonia to cell killing, and (d) the capacity of stem cells in relatively radiation-free areas to progressively assume the major spermatogenic role.

6688 **Radiation-induced DNA content variability in mouse sperm.** Pinkel, D.; Gledhill, B.L.; van Dilla, M.A.; Lake, S.; Wyrobek, A.J. (Lawrence Livermore National Lab., CA). *Radiation Research;* **95**: No. 3, 550-565(Sep 1983). Contract W-7405-ENG-48.

Mouse sperm collected from the cauda epididymidis 35 days after acute testicular x-ray exposure and fluorescently stained for DNA show dose-dependent increases in the coefficient of variation (CV) of flow cytometrically obtained fluorescence distributions. By comparing dose-response curves obtained with three protocols which overcome the optical and cytochemical difficulties of sperm measurement in different ways we conclude the response is due to x-ray-induced DNA content variability. Computer modeling of the shapes of the fluorescence distributions show that at 600 rad 30 to 40% of the sperm have abnormal DNA content. Some have errors as large as two whole chromosomes, but it is not clear whether they are due to whole chromosome nondisjunction or a finer fragmentation of the genome. Exposures to benzo(a)pyrene and mitomycin C cause no detectable DNA content variability. We conclude mouse sperm DNA content measurements are not sensitive to small amounts of aneuploidy and as such will only be useful in detecting agents that produce substantial DNA content variability. Another animal with a smaller number of chromosomes might be more favorable. These sperm measurement techniques may find additional application in other areas of reproductive biology, such as the determination of the relative numbers of X and Y chromosome-bearing sperm in semen that may be artificially enriched in one population.

6689 **Interpretation of cytogenetic damage induced in the germ line of male mice exposed for over 1 year to ^{239}Pu alpha particles, fission neutrons, or ^{60}Co gamma rays.** Grahn, D.; Lee, C.H.; Farrington, B.F. (Argonne National Lab., IL). *Radiation Research;* **95**: No. 3, 566-583(Sep 1983). Contract W-31-109-ENG-38.

The relative biological effectiveness (RBE) of ^{239}Pu α particles, fission neutrons (0.85 MeV), and ^{60}Co γ rays has been evaluated for the induction of reciprocal chromosome translocations in spermatogonia and of chromosome/chromatid fragments and chromatid rearrangements in the primary spermatocyte of adult male $B6CF_1$ mice. Age concurrency was maintained for both internal and external radiations which were delivered at about 1 rad/week for ^{239}Pu (single intravenous dose of 10 μCi/kg), 0.67, 1.67, and 2.67 rad/week for neutrons, and 6.95, 17.4, and 32 rad/week for γ rays for at least 60 weeks. In terms of frequency of translocations, the response to the alpha emitter was nonlinear (concave downward) with little dose-response predictability; to cumulative neutron exposures the response was linear, without evidence of a dose-rate effect; and to γ radiation the responses were linear, and a significant dose-rate effect was seen. RBE estimates are variable. The overall response to the α emitter is interpreted to be a complex function of (a) microdosimetric heterogeneity, (b) a nearly invariant deposition pattern in the gonad, (c) the high sensitivity of differentiating spermatogonia to cell killing, and (d) the capacity of stem cells in relatively radiation-free areas to progressively assume the major spermatogenic role.

6690 **Comparative toxicity of ^{226}Ra, ^{239}Pu, ^{241}Am, ^{249}Cf, and ^{252}Cf in C57BL/Do black and albino mice.** Taylor, G.N.; Mays, C.W.; Lloyd, R.D.; Gardner, P.A.; TAlbot, L.R.; McFarland, S.S.; Pollard, T.A.; Atherton, D.R.; van-Moorhem, D.; Brammer, D. (Univ. of Utah School of Medicine, Salt Lake City). *Radiation Research;* **95**: No. 3, 584-601(Sep 1983). Contract AC02-76EV00119.

Groups of C57BL/Do (black and albino) mice were injected with graded activities of ^{226}Ra, ^{239}Pu, ^{241}Am, ^{249}Cf, or ^{252}Cf and were followed throughout life. Bone sarcoma was the principal radiation-induced end point, and the risks associated with average skeletal doses of the four transuranium radionuclides, relative to radium, were determined. The relative biological effectiveness (RBE) was calculated for each emitter by dividing its risk coefficient (bone sarcomas per 10^6 mouse-rad) by the risk coefficient for

^{226}Ra. Combined data for males and females in both black and albino mice gave the following values +- SD for the RBE relative to ^{226}Ra = 1.0: ^{239}Pu = 15.3 +- 3.9, ^{241}Am = 4.9 +- 1.4, ^{249}Cf = 5.0 +- 1.4, and ^{252}Cf = 2.6 +- 0.8. About 70% of the tumors occurred in the axial skeleton, and the risk coefficient for females averaged about four times higher than for males when all five nuclides were included. The RBE of fission fragment irradiation from ^{252}Cf for cancer induction, relative to α irradiation, for the combined data in all of the animals given ^{252}Cf and ^{249}Cf, was 0.02 +- 0.28, in agreement with the calculated theoretical value of 0.03, based on the ratio of summed track lengths in tissue.

6691 **239Pu metabolism in newborn and weanling pigs.** McClanahan, B.J.; Mahlum, D.D. (Biology Department, Pacific Northwest Laboratory, Richland, WA). *Health Physics;* **44**: No. 5, 533-539(May 1983).

Newborn (1-2 days old) and weanling (6 wk old) miniature pigs were injected intravenously with 239Pu citrate. Animals from each age group were killed at intervals over a 28-day period to obtain distribution and retention data. The most notable difference between the two age groups was in hepatic deposition and retention. One day after injection, the plutonium content of the liver in neonates was only one-third that in weanling pigs (4.3 vs 13.9% of administered 239Pu). Deposition and retention were not markedly different in individual skeletal components. Cumulative excretion during the first 7 days after injection was the same for each group--1.4% of the injected plutonium.

6692 **Die Wirkung von Bleiacetat, Wismutchlorid und Roentgenbestrahlung auf den Sterblichkeitsverlauf und auf die GOT-, GPT- und O-Demethylase-Aktivitaet bei (weissen) Maeusen. (Effect of lead acetate or bismuth chloride and X-radiation on mortality and GOT, GPT, and O-demethylase activity of white mice).** Hauke, R. Freiburg, Germany, F.R.; Freiburg University (1981). 54p. (In German). Library of Freiburg Univ. (Germany, F.R.).

Thesis.

The injection of 100 mg/kg body weight of lead acetate led to a temporarily advanced mortality induced by X-radiation. The corresponding advanced mortality due to bismuth chloride (250 mg/kg body weight) was only minor. In view of the activity presented by the SGOT and SGPT and of the O-demethylase of the liver, the impairing effects of lead acetate on the radiation injuries cannot be attributed to a hepatic damage. In cases of radiation damages an intensification of bacteriaemia due to lead acetate neither appears probable. Considering the mortality course we probably have to proceed from the supposition that lead acetate intensifies the radiation damage by reducing the endotoxine-detoxicant ability of the RES.

6693 **Untersuchungen ueber die Faehigkeit bestrahlter Escherichia Coli Bakterien, Roentgen-inaktivierte Bakteriophagen lambda zu reaktivieren. (Studies on the ability of irradiated Escherichia coli bacteria to reactivate X-ray inactivated bacteriophages).** Kiessling, W. Muenchen, Germany F.R.; Muenchen Universitaet (1980). 28p. (In German). Library of Muenchen Univ. (Germany, F.R.).

Thesis.

The Weigle Reactivation phenomenon, i.e. the observation that low UV-flow irradiated bacteria increase the survival rate of UV-irradiated phages, has not, to date, been studied with other forms of irradiation as inducers. In the studies reported here lambda-phages and E. coli cells in LB-medium were treated with X-rays. Host cells treated with an X-ray dose from 85 to 765 Gy showed a reactivation factor of 1.3 to 3.0 for X-ray inactivated phages. The capacity of the bacteria for phage reproduction did not appear to be markedly diminished. A reactivation factor of 1.3 only was found for X-irradiated phages when host cells were treated with UV-irradiation. The low Weigle reactivation of X-ray treated phages compared to UV-treatment was found to be due to a diminished absorption capacity, as demonstrated by the determination of free non-absorbed phages by filtration of radioactive-labelled phage-host-complexes. Reactivation studies on X-irradiated phages with various host bacteria of different radiation sensitivities confirm this finding.

6694 **Untersuchungen ueber somatische Spaetschaeden nach ausgedehnter Strahlentherapie. (Delayed somatic effects following extended radiotherapy. Studies of 135 patients with Hodgkin's disease in long-term remission (Freiburg collective, treatment years 1948 to 1974)).** Slanina, J. Freiburg, Germany, F.R.; Freiburg Universitaet (1977). 147p. (In German). Library of Freiburg Univ. (Germany, F.R.).

Thesis.

A group of 135 patients who suffered from Hodgkin's disease with long-term remission following radiotherapy was investigated. By restricting the investigations to the patient group with long-term remission and correlative examinations, it was tried to differentiate between exclusive or principal delayed radiation effects and delayed effects due to other factors. The study reports about the most significant results obtained in the fields of catamnesis, laboratory diagnostics, hematology, pulmology, cardiology, thyroid function tests, neurology, andrology and dermatology. Due to the numerous detectable delayed effects the group of patients with long-term remission receives a special status. Although those effects are in no proportion to the deletary risks of an untreated Hodgkin's disease and though they are consequently tolerable in the present state of the therapeutic development, they must initiate the completion of the therapeutic concept including performance of radiotherapy and aftercare, because only then the risk for the patient provoked by these effects, which ranges beyond the malignity of this disease can be reduced or prevented.

6695 **Radiation effects on mouse lymphoma cells in culture.** Wood, P.J. Bath, England; Bath University ([nd]). 273p. British Library, Boston Spa, Wetherby, West Yorks. No. D43062/82.

Thesis.

The thesis is concerned with the development of culture techniques for mouse lymphoma cell lines L5178Y, JL, L5178YS and AIV, together with a soft agar suspension procedure for assessment of viability. The inactivation of the four cell lines, in two stages of growth, by gamma radiation and 254 nm, 313 nm and 365 nm ultraviolet radiation was compared, and a preliminary investigation made into the mutagenic response of L5178Y cells to 254 nm and 313 nm radiation in two mutation assay systems, ouabain resistance and 6-thioguanine resistance. The sensitisation of 313 nm radiation inactivation and mutation of L5178Y cells by the sunscreen agent para-amino benzoic acid (PABA) was investigated together with a method of producing mutants of L5178Y cells which are sensitive to 254 nm radiation. A review is presented of the current knowledge of the mechanisms for the repair of radiation induced damage in bacteria and mammalian cells, and general conclusions are drawn concerning the use of L5178Y for the elucidation of mammalian cell repair mechanism.

5602 Thermal Effects

REFER ALSO TO CITATION(S) 5860

6696 **(DPST—83-521) L-Reactor thermal blockage of Boggy Gut Creek.** (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 19 Sep 1983. Contract AC09-76SR00001. 11p. NTIS, PC A02/MF A01. Order Number DE84003480.

L-Reactor thermal discharges will result in an increase in the size of the thermal plume in the Savannah River downstream of the mouth of Steel Creek. Conservative calculations (i.e., conducted using a low river flow rate) indicate potential fish avoidance of the mouth of Boggy Gut Creek during the peak spawning period for Savannah River anadromous fish. 4 references. 6 figures.

5603 Chemicals Metabolism And Toxicity

REFER ALSO TO CITATION(S) 5734, 5735, 6595, 6615, 6671

6697 (CONF-8205230—Summ.) **Establishment of a bioassay system for cancer risk assessment in energy technology.** Ts'o, P.O.P.; Bruce, S.A.; Brown, A. (eds.). (Johns Hopkins Univ., Baltimore, MD (USA). School of Hygiene and Public Health). Sep 1983. Contract FG02-82ER60057. 196p. NTIS, PC A09/MF A01. Order Number DE84001127.

From Conference on establishment of a bioassay system for cancer risk assessment in energy technology; Baltimore, MD, USA (3 May 1982).

Portions are illegible in microfiche products.

Separate abstracts were prepared for 20 papers in this report. For several years the Department of Energy (DOE), Office of Health and Environmental Research (OHER), has supported a research program aimed at developing new experimental approaches for the improvement of cancer risk assessments. The central issue is to overcome the organizational, species and other barriers that make it difficult to extrapolate laboratory-based data to predict risk to man. Most of the participants at the meeting are involved in research aimed at understanding the mechanism(s) of chemical carcinogenesis. Complex mixtures of chemicals are associated with many energy technologies. DOE's initial program emphasis focused on semi-applied research aimed at quantitative evaluation of carcinogenic activity of complex materials. Since much progress has been made in DOE integrated technology-specific chemical-biological characterization studies, the number and kinds of chemicals of concern has been reduced to a relatively few well-defined classes. Although the classes of compounds seem to be unique to some of the synfuel technologies, they are quite similar to compounds of general interest, for example, poly-nuclear aromatic hydrocarbons. Special emphasis was placed on molecular and cellular dosimetry as one of the key requirements for quantitative comparison of effects at the cell level in vivo and in vitro. Although it is relatively easy to measure cell, tissue, organ and whole organism doses associated with radiation exposures, we are just learning how to do this for chemical agents. Several methods have been developed in the past several years which can be used.

6698 (CONF-8205230—Summ., pp 87-88) **Metabolic activation of carcinogens.** Gelboin, H.V. (National Cancer Inst., Bethesda, MD). Sep 1983. NTIS, PC A09/MF A01.

From Conference on establishment of a bioassay system for cancer risk assessment in energy technology; Baltimore, MD, USA (3 May 1982).

A primary and essential consideration that is central to any system of risk assessment is the now well-established fact that most carcinogens require metabolic activation to exert their carcinogenic activity. The metabolic activation as well as the detoxification of carcinogens are carried out by several enzyme systems. The primary or initial interaction of carcinogens with mammalian organisms is with the cytochrome P-450 containing mixed function oxidases. Other metabolically subsequent enzyme systems are epoxide hydrolases, and several transferases including glutathione, sulfate and uridinediphosphoglucuronyl transferase. In any system used for risk assessment it is imperative that the appropriate activating enzymes be present. The cytochromes P-450, for example, are present in different forms and each isozyme of cytochrome P-450 may display a unique but overlapping specificity with other cytochromes P-450. Thus, the profile of the latter enzymes may govern the relative amounts of activation or detoxification in a tissue or organ. A risk assessment system will fail if the proper mix of enzymes is lacking. The recent use of monoclonal antibodies specific for different cytochromes P-450 will permit a detailed analysis and phenotyping of tissues able to catalyze the activation reaction for a given carcinogen. Activation systems need be better defined than simply S-9 supernatant. Perhaps this will be better achievable when the latter enzymes are characterized as to structure and enzyme specificity.

6699 (CONF-8205230—Summ., pp 91-92) **Role of DNA repair in carcinogenesis.** Setlow, R.B. (Brookhaven National Lab., Upton, NY). Sep 1983. NTIS, PC A09/MF A01.

From Conference on establishment of a bioassay system for cancer risk assessment in energy technology; Baltimore, MD, USA (3 May 1982).

DNA damage resulting from exposure to environmental chemicals is determined by the environmental exposure level and the metabolism of the chemical. However the concentration of the ultimate carcinogen in the neighborhood of DNA, and so the rate of formation of DNA adducts, relate more closely to the actual carcinogenic potential of a chemical. Some chemicals result in an adaptive response in which the levels of metabolism or repair enzymes may be enhanced. Nucleotide excision repair is much better in humans than in rodents. This repair system works not only on ultraviolet radiation, but on its kinetics, such as the polycyclic aromatic hydrocarbons. We know from a comparison of the cancer susceptibilities in humans with the disease xeroderma pigmentosum (XP) that a defect in DNA repair in XP of approximately 70% to 80% results in a 10^4-fold increase in cancer susceptibility. A number of recent measurements on unscheduled DNA synthesis in human lymphocytes and their ability to remove alkyl groups from DNA shows variations appreciably greater than this value in the normal population.

6700 (CONF-8205230—Summ., pp 96-99) **Mechanisms of tumor promotion.** Barrett, J.C. (National Inst. of Environmental Health Sciences, Research Triangle Park, NC). Sep 1983. NTIS, PC A09/MF A01.

From Conference on establishment of a bioassay system for cancer risk assessment in energy technology; Baltimore, MD, USA (3 May 1982).

Tumor promoting factors have been suggested to play an important role in the development of human cancers. Therefore, quantitative risk analysis of this class of cocarcinogens is very important. The mechanism of two-stage carcinogenesis, described originally nearly forty years ago as the ability of certain treatments to promote tumor formation initiated by a non-carcinogenic dose of a chemical remains undefined today. There are two possible cellular mechanisms for tumor promotion.

6701 (CONF-8205230—Summ., pp 113-117) **Current progress of the International Agency for Cancer Research.** Yamasaki, H. (International Agency for Research on Cancer, Lyon Cedex, France). Sep 1983. NTIS, PC A09/MF A01.

From Conference on establishment of a bioassay system for cancer risk assessment in energy technology; Baltimore, MD, USA (3 May 1982).

In February, 1982, an International Working Group of experts in chemical carcinogenesis met in Lyon to reevaluate the carcinogenic risk to humans for all chemicals, group of chemicals, industrial processes or occupational exposure considered in IARC Monographs, Vol. 1 to 29, and for which data on cancer in humans are available. Each evaluation was based upon all available published data from human epidemiological studies and animal experiments summarized previously and published in the respective IARC monograph, and all new data published since the appearance of that monograph. In addition, data from short-term tests were summarized, again on the basis of both previously evaluated and more recent data.

6702 (CONF-8205230—Summ., pp 118-120) **Development of predictive short-term assays.** Mendelsohn, M. (Lawrence Livermore Lab., CA). Sep 1983. NTIS, PC A09/MF A01.

From Conference on establishment of a bioassay system for cancer risk assessment in energy technology; Baltimore, MD, USA (3 May 1982).

The human data base is sparse and, except for radiation carcinogenesis, is non-quantitative. The rodent cancer bioassay is a non-validated surrogate for human carcinogenesis. It has a limited data base, heavily biased toward positive chemicals and certain chemical classes. It is probably not representative of environmental chemicals. It focuses on long-term repeated exposure at high (near lethal) doses. Outright disagreements with human data and between rat and mouse are well known for the cancer bioassay. The better short-term assays for carcinogenesis is probably perform against the cancer bioassay in the 50 to 90% range of correct assignments depending on chemical class. This estimate is controversial and by and large involves very small data bases. True predictivity is unknown. In spite of its shortcomings, the cancer bioassay has reason-

able credibility and legal acceptability. The short term assays, although widely used as operational surrogates for the slow and expensive cancer bioassay, do not share this credibility or acceptability. Any new bioassay will face the same problems and unless dramatically superior to what is available will go through a long period of data accumulation and familiarization.

6703 (CONF-8205230—Summ., pp 132-135) **Extrapolation from animals to humans using dose response curves.** Setlow, R. (Brookhaven National Lab., Upton, NY). Sep 1983. NTIS, PC A09/MF A01.

From Conference on establishment of a bioassay system for cancer risk assessment in energy technology; Baltimore, MD, USA (3 May 1982).

A key question is how to extrapolate the results obtained on simple test systems, or even animals, to risks to humans from environmental pollutants. The problem is even more difficult than it may seem if one is dealing with mixtures of reactive components. A first problem is how one should compare experiments on the transformation of animal cells in culture to the results of skin painting experiments and to experiments in which animals are fed carcinogens. How should one compare the dosimetry in these situations. A step of equal difficulty is how to extrapolate from animal cells in culture to human cells in culture. One way of doing this is conceivable dose response relations for cytotoxicity, mutation and transformation for both the unknown substance and the known compound. It would be useful to have basic knowledge to permit the construction of theories that would guide one in the extrapolation from cells in culture to whole animals. The construction of such theories is a goal to put the extrapolation procedure on a firm foundation.

6704 (CONF-8205230—Summ., pp 136) **Studies of human epithelial cells.** Smith, H.S. (Peralta Cancer Research Inst. Oakland, CA). Sep 1983. NTIS, PC A09/MF A01.

From Conference on establishment of a bioassay system for cancer risk assessment in energy technology; Baltimore, MD, USA (3 May 1982).

One of the major difficulties with evaluating chemical carcinogenesis on human cells is the fact that one cannot readily correlate in vitro data with effects modulated by the whole host. One suggested approach was to utilize chimeras (cultured human cells grafted into rodents). Progress along these lines has been reported for tracheal cells implanted onto prepared rodent tracheal beds. Concern was expressed that the rodent metabolic profile might be very different from the human one; hence the chimera might not accurately reflect the carcinogenicity in humans.

6705 (CONF-8205230—Summ., pp 137-138) **Administrative network required for the establishment of bioassay system in the Department of Energy.** Griesemer, R.A. (Oak Ridge National Lab., TN). Sep 1983. NTIS, PC A09/MF A01.

From Conference on establishment of a bioassay system for cancer risk assessment in energy technology; Baltimore, MD, USA (3 May 1982).

The Department of Energy's health effects research differs from that of most other federal agencies in that the substances of importance tend to be complex mixtures rather than pure substances. Since multiple tests will be performed in many laboratories to take advantage of the special skills and techniques in University and National Laboratories, it is desirable that all the tests be conducted on the same test substance. I propose that one or several contract laboratories be charged to (a) purchase or synthesize test substances; (b) characterize them chemically and physically; (c) identify impurities; (d) store them; (e) provide aliquots as needed to research laboratories; and (f) maintain a chemical repository (library) so that representative materials would be available for follow-up experiments on the same substances. A contractor could be charged with providing all investigators bibliographic lists, hard copies of articles, and possibly analyses or monographs when warranted. The resulting bibliographic data base would serve as a national resource. The use of proprietary information requires review and safeguards.

6706 (CONF-8205230—Summ., pp 139) **Comments on the use of molecular and cellular assays for cancer risk assessment.** Griesemer, R. (Oak Ridge National Lab., TN). Sep 1983. NTIS, PC A09/MF A01.

From Conference on establishment of a bioassay system for cancer risk assessment in energy technology; Baltimore, MD, USA (3 May 1982).

At present only two approaches for detecting carcinogens are generally accepted, the study of exposed humans or lifetime bioassays in animals. Human studies have several advantages including obtaining the data directly from the species of interest. But there is an overriding concern since human studies cannot be performed until people have been exposed to potentially hazardous chemicals. Animal bioassays have emerged as a suitable method to detect carcinogens. The sensitivity of the assays is known for only a few chemicals. The data base of substances both adequately tested in animals and adequately studied in man is very small. A proposed scheme would be as follows: dose → molecular studies → cell transformation → animal bioassays. The proposed scheme indicates that the most likely short-term substitutes for animal bioassays are in vitro cell transformation assays.

6707 (CONF-8205230—Summ., pp 140-142) **Research directions and effects in Inhalation Toxicology Research Institute.** Brooks, A.L. (Inhalation Toxicology Research Inst., Albuquerque, NM). Sep 1983. NTIS, PC A09/MF A01.

From Conference on establishment of a bioassay system for cancer risk assessment in energy technology; Baltimore, MD, USA (3 May 1982).

Our prime interest at the Inhalation Toxicology Research Institute is in the health impact of airborne pollutants. Because of this we have concentrated our research efforts on the respiratory tract. The research approach has been to collect relevant samples, to characterize their chemical and biological properties using standard chemical and bioassay techniques and to identify model compounds that play a major role in the biological activity. These compounds are then synthesized and studied in more relevant respiratory tract cell systems and in whole animal experiments. This approach allows us to build a matrix of dose-response information on several biological endpoints for each technology. It also provides a useful set of in vivo and in vitro data to bridge the gap between experimental animals and cells in culture.

6708 (CONF-8205230—Summ., pp 143-158) **Cell transformation assays for quantitative risk estimation.** Barrett, J.C. (National Inst. of Environmental Health Sciences, Research Triangle Park, NC). Sep 1983. NTIS, PC A09/MF A01.

From Conference on establishment of a bioassay system for cancer risk assessment in energy technology; Baltimore, MD, USA (3 May 1982).

Cell Transformation assays can be used to study the cellular changes involved in carcinogenesis. These studies can provide information needed for understanding the nature of these changes, the influence of environmental factors on the changes, as well as the possible identification of inhibitors of these changes. Cell tranformation studies have demonstrated the multistep nature of neoplastic development and have indicated that environental factors can act at one or more stages in this process. Furthermore, different steps in malignant progression of cells may be influenced by different environmental factors. Cell culture assays can be used to identify possible carcinogenic hazards to man, to define the step(s) in neoplastic development which are affected by these substances, and to compare the relative risk of these agents in defined steps of carcinogenesis. The complete assessment of carcinogenic risk, however, requires consideration of the role of host factors as well as the cellular events in cancer.

6709 **(DOE/EV/10731—3) Analysis of health effects resulting from population exposures to ambient particulate matter. Health and environmental effects document, 1983. Health and Environmental Risk Analysis Program.** Oezkaynak, H.; Thurston, G.D.; Tosteson, T.D.; Smith, C.M.; Kinney, P.L.; Beck, B.; Skornik, W.; Colome, S.D.; Schatz, A. (Harvard Univ., Cambridge, MA (USA). Energy and Environmental Policy Center). Oct 1983. Contract AC02-81EV10731. 101p. NTIS, PC A06/MF A01. Order Number DE84004421.

Combustion-related energy systems represent a major source of airborne particles. An assessment of the current and future health impacts of energy systems requires an understanding of the nature, magnitude and uncertainty of potential health effects from these particles. This generic Health and Environmental Effects Document (HEED) on airborne particles presents results from the second year of an ongoing study of human exposure and response to ambient particulate matter. As such, it also draws from information included in our 1982 HEED. The 1983 HEED emphasizes our efforts over the past year and continues to develop estimates of the magnitude and range of potential health effects from exposure to particles. Using published findings and reanalyses of data available from epidemiologic, toxicologic and aerometric studies, we have, in this report, attempted to evaluate effects of particles. Where the available data permit, we have related health effect outcomes (which include morbidity and mortality) to concentrations of particulate matter according to size, composition and source of aerosol. Special attention is given to the uncertainty associated with estimates of effects. Deficiencies are identified in the data bases required to make assessments, and recommendations are given for future studies and analytical efforts which would serve to better identify and quantify impacts.

6710 (INIS-mf—8591, pp 71) **Bud induction in the moss Funaria hygrometrica by cytokinin and the analysis of its action.** Hahn, H.; Stegmann, J. (Bonn Univ. (Germany, F. R.), Inst. fuer Botanik). Oct 1981. NTIS (US Sales Only), PC A07/MF A01. (CONF-8110297—Summ.).

From 3. symposium on plant growth regulators; Varna, Bulgaria (18 Oct 1981).

6711 **(N—8326400) Proceedings of the Twelfth Conference on Environmental Toxicology.** (California Univ., Irvine (USA)). Apr 1982. 411p. (CONF-8111192—; AD-A—115900). NTIS, PC A16/MF A01.

From 12. environmental toxicology conference; Dayton, OH, USA (3 Nov 1981).

Papers were presented in the area of animal modeling of carcinogenesis, sex-related factors influencing toxicity, use of experimental toxicologic data in estimating occupational hazards, use of physiologic kinetics in toxicology, and effects of toxic substances on aquatic organisms. For individual titles, see N83-26401 through N83-26419.

6712 **(N—8326405) Metabolism of benzo(a)pyrene in cultured human bronchus.** Stoner, G.D.; Daniel, F.B. (Medical Coll. of Ohio, Toledo (USA)). Apr 1982. 15p. (CONF-8111192—). NTIS, PC A16/MF A01.

From 12. environmental toxicology conference; Dayton, OH, USA (3 Nov 1981).

In Proc. of the 12th Conf. on Environ. Toxicol. p 68-82 (SEE N83-26400 15-51).

Lung cancer is a major cause of cancer deaths in many countries. Based on clinical, experimental, epidemiologic and autopsy data, cigarette smoking has been identified as the major risk factor in the development of lung cancer. The majority of lung cancers in man are bronchiogenic carcinomas which are thought to arise from a metaplastic squamous differentiation of the large bronchi. Polycyclic aromatic hydrocarbons, such as benzo(a)pyrene (PB), found in cigarette smoke and environmental pollutants, were associated with lung cancer in man. Since most chemical carcinogens have to be metabolically activated in the body before exerting their carcinogenicity, it is important to study the metabolic fate of benzo(a)pyrene in the human bronchus. Recent developments in the maintenance and growth of viable human epithelial tissues and cells in vitro have made possible the study of chemical carcinogenesis directly in human tissue.

6713 **(N—8326411) Evaluating health hazards associated with aircraft fuel cell maintenance.** Bishop, E.C. (Air Force Occupational and Environmental Health Lab., Brooks AFB, TX (USA)). Apr 1982. 11p. NTIS, PC A16/MF A01.

In Proc. of the 12th Conf. on Environ. Toxicol., p 192-202 (SEE N83-26400 15-51).

Problems commonly encountered when toxicologic standards are applied to everyday worker exposures are demonstrated. The primary function of the industrial hygienist is to evaluate the workplace to insure a healthful environment for the worker. In general, this evaluation is accomplished by taking samples representative of the worker's environment, analyzing for contaminants of interest, and comparing the measured levels with appropriate standards. Control measures are instituted if contaminant levels are above the standard or some present fraction of the standard (NIOSH action level concept). Although the evaluation procedure may seem simple as described, it is a nontrivial task as demonstrated using the example of a recent evaluation of worker exposures during aircraft fuel cell maintenance.

6714 **Response of agronomic and forest species to elevated atmospheric carbon dioxide.** Rogers, H.H. (North Carolina State Univ., Raleigh); Thomas, J.F.; Bingham, G.E. *Science (Washington, D.C.);* **220**: 428-429(Apr 1983). Contract AI01-81ER60001.

The effects of atmospheric carbon dioxide on corn, soybeans, loblolly pine, and sweethum were studied in the field during a growing season. The plants were exposed to a range of concentrations of carbon dioxide day and night in open topped, flow-through chambers. At a mean daytime carbon dioxide concentration of 910 parts per million, increases in total biomass ranged form 157 to 186 percent of the control values. Seed yield and wood volume increased and there were changes in plant anatomy and form. Net photosynthesis increased with increasing carbon dioxide concentration in soybeans and sweetgum, but was unaffected in corn. Water use efficiency also increased in corn, soybeans, and sweetgum.

6715 **The induction of specific-locus mutations and sister-chromatid exchanges by 5-bromo- and 5-chloro-deoxyuridine.** Heartlein, M.W. (Univ. of Tennessee, Oak Ridge); O'Neill, J.P.; Pal, B.C.; Preston, R.J. *Mutation Research;* **92**: 411-416(1982). Contract W-7405-ENG-26.

The induction of 6-thioguanine-resistant (TG/sup r/) mutants and sister-chromatid exchanges (SCE) by 5-bromo- and 5-chloro-deoxyuridine (BrdU and CldU) was determined with Chinese hamster ovary cells in culture. Over a concentration range of 0.5-200 μM, CldU treatment caused 3-5 times the number of SCEs found with BrdU; for example, with 10μM CldU, 60.0+/-14.2 SCEs/metaphase (mean +/-S.D.) were induced, while with 10μMBrdU, only 14.6+/-4.1 SCEs/metaphase were found. Despite this difference in SCE induction, both compounds were mutagenic only at concentrations greater than 50 μM, and BrdU was more mutagenic than CldU. These results indicate that SCEs and gene mutations are induced by these thymidine analogs through 2 different mechanisms.

6716 **Ozone flux in glycine max (L.) merr.: sites of regulation and relationship to leaf injury.** Taylor, G.E. Jr. (Oak Ridge National Lab., TN); Tingey, D.T.; Ratch, H.C. *Oecologia;* **53**: 179-186(1982). Contract W-7405-ENG-26.

Hood and Dare cultivars of soybean, Glycine mas (L.) Merr., vary in their foliar response to ozone. The physiological basis of this variation was investigated as a function of leaf age through an analysis of ozone flux data, leaf developmental morphology, and analogue modelling techniques. At all concentrations (0.25-0.58 μl 1/sup -1/) and exposure times (1-4 h), resistance to O_3 flux in the gas phase of the diffusive pathway (i.e., boundary layer and stomate) did not account fully for variation in pollutant uptake rates into the leaf interior. Ozone molecules experienced a residual resistance to diffusion that is not shared by effluxing water vapor molecules. Residual resistance to O_3 flux increased with pollutant concentration and exposure time and was associated with age-dependent differences in foliar O_3 response. Leaf morphology data, including stomatal frequency and the ratio of internal to external

surface area, did not help explain cultivar or age-dependent differences in O_3 flux. The extent of foliar injury was not consistently related ot the magnitude of O_3 flux into the leaf interior. An analysis of the residual resistance to O_3 flux suggests that the gas and liquid phase pathways for O_3 flux suggests that the gas and liquid phase pathways for O_3, water vapor, and carbon dioxide are not identical.

6717 **Supermutagenicity of ethylnitrosourea in the mouse spot test comparisons with methylnitrosourea and ethylnitrosourethane.** Russel, L.B.; Monitgomery, C.S. (Oak Ridge National Lab., TN). *Mutation Research;* **92**: 193-204(1982). Contract W-7405-ENG-26.

The effects of the 3 related compounds ethylnitrosourea (ENU), methylnitrosourea (MNU), and ethylnitrosourethane (NEC) were studied in the mouse spot test. ENU induces a large number of recessive spots (RS) and, due to its low toxicity, can be applied at relatively high doses. This combination of properties makes it the most efficient spot-test mutagen, as shown in a comparison with 16 other chemicals, even though, on the basis of molarity, it is not the most potent one. The ENU mutation frequency in cells at risk, calculated per locus, per unit of applied dose, is roughly similar for melanocyte precursors (in the spot test) and spermatogonial stem cells (in the specific-locus test). MNU which, due to its high embryotoxicity, oculd be tested only at a low dose, is clearly mutagenic, and dose extrapolations indicate it to be more potent than ENU. NEC, though it could be tested at higher molarities than ENU, is only weakly mutagenic. The spot test, in addition to mutational data, also yields information on cytotoxicity finding parallel earlier results in the rat. For all endpoints studied, ENU is more effective than NEC. Relative to MNU, ENU is less toxic, less teratogenic, and less mutagenic in the spot test; but it is much more carcinogenic (transplacentally) and more mutagenic in spermatogenic in spermatogonia.

5604 Other Environmental Pollutant Effects

6718 **(ATR—80(7810)-2) Highlights of technical support to the Department of Energy, Division of Electric Energy Systems, Electric Power and Transmission Programs. Final technical report, 1979-1980.** Wisecup, W.G. (Aerospace Corp., Germantown, MD (USA)). Feb 1980. Contract AC01-79ET29007. 11p. NTIS, PC A02/MF A01. Order Number DE83018212.

A multidisciplinary research program is being conducted on the biological effects of electromagnetic fields associated with high-voltage 60-Hz and dc overhead transmission lines. Assistance and technical support to this program are reported. (DLC)

6719 **(ATR—81(7890)-2) Highlights of technical support to the Department of Energy, Division of Electric Energy Systems, Electric Power and Transmission Programs. Final technical report, 1980-1981.** (Aerospace Corp., Germantown, MD (USA)). Feb 1982. Contract AC01-80RA50157. 13p. NTIS, PC A02/MF A01. Order Number DE84000474.

A broad-based, multidisciplinary research program is being conducted to study biological effects of electric and magnetic fields from high-voltage transmission lines. Assistance and technical support for this program are reported. (DLC)

6720 **(N—8327572) USSR report: Life sciences. Effects of nonionizing electromagnetic radiation, No. 9.** (Joint Publications Research Service, Arlington, VA (USA)). Jun 1983. 44p. (JPRS—83601). NTIS, PC A03.

Effects of nonionizing electromagnetic radiation on organisms and biological tissues are reported. Topics discussed are: effects of decimeter waves, microwave effects, mathematical modeling methods, alternating magnetic fields and magnetic field effects, electrostate field effects, magnetic field therapy, decimeter wave treatment, biological effects of ultraviolet radiation, high frequency and ultrahigh frequency electric fields.

6721 **(N—8327574) Morphological effects of chronic action of SHF field on nervous system of mice.** Antipov, V.V.; Drobyshev, V.I.; Tikhonchuk, V.S.; Fedorov, V.P.; Pakhunova, L.V. (Joint Publications Research Service, Arlington, VA (USA)). Jun 1983. 7p. NTIS, PC A03.

In USSR report: Life Sci. Effects of Nonionizing Electromagnetic Radiation, No. 9 (JPRS-83601) p 14-20 (SEE N83-27572 16-51). Translated from Med. Radiol. (Moscow); No. 7, 58-62(Jul 1982).

Changes in the nervous system after exposure to electromagnetic radiation in the microwave range were investigated. Significant morphological changes upon exposure to intensive microwave effects are noted. The biological effects of low intensity SHF electromagnetic radiation were minor changes in the system. The possible changes in the organism when exposed to thermal levels are studied with regard to the increasing interest of clinicians in the use of SHF electromagnetic radiation for therapeutic purposes. Questions of the specific nature of the changes and effects of cumulation of damage are studied. The morphological reaction of the central nervous system is compared to the peripheral nervous system.

6722 **(N—8327576) Function of adreno-pituitary system in various regimes of effect of alternating magnetic field of industrial frequency.** Udintsev, N.A.; Moroz, V.V. (Joint Publications Research Service, Arlington, VA (USA)). Jun 1983. 7p. NTIS, PC A03.

In USSR report: Life Sci. Effects of Nonionizing Electromagmetic Radiation, No. 9 (JPRS-83601) p 29-35 (SEE N83-27572 16-51). Translated from Gig. Tr. Prof. Zabol. (Moscow); No. 12, 54-56(Dec 1982).

Magnetic fields which are widely utilized in industry and in the national economy and their effects were examined. Under production conditions workers are subjected to the effect of highly significant constant and alternating magnetic fields producing functional shifts in the neuroendocrine, cardiovascular and other systems. The standards for the maximum permissible level of effect of magnetic fields during work with magnetic devices and materials were established. The nature of the reaction to the effect of an alternating magnetic field depending on the duration and frequency of the field's effect were evaluated. The dynamics of the function of the basic links of the adrenopituitary system, which plays an important role in the mechanism of adaptation and is sensitive to the effect of a magnetic field were studied. Alternating magnetic fields of an induction of 20 mT of an industrial frequency possessing a significant biological activity for man are examined.

6723 **Increased serum enzyme activity in microwave-exposed rats.** Lu, S.T.; Michaelson, S.M.; Petitit, S. (Univ. of Rochester, NY). *Radiation Research;* **96**: No. 1, 152-159(Oct 1983). Contract AC02-76EV03490.

Heat stable serum enzymes were studied in rats exposed to microwaves (2.45 GHz, 120 Hz amplitude modulated) 24 hr after a single 4-hr exposure or immediately after 3 and 10 exposures to 0.1 to 55 mW/cm^2. In addition, stable colonic temperature at 41.5°C for 30 min was maintained by microwave exposure in a group of five rats under barbiturate anesthesia. Alkaline phosphatase and lactic dehydrogenase did not increase as a result of microwave exposure. Increased serum glutamic pyruvic transaminase (GPT) and glutamic oxaloacetic transaminase (GOT) were noted in the 41.5°C group 24 hr after exposure. A threshold body temperature for acute cellular injury after microwave exposure was demonstrated. The acute cellular injury could be in the liver. These mild elevations in the serum enzyme levels (mean +-SE, GOT = 167 +- 40 U/liter; GPT = 74 +- 26 U/liter) indicated that the injuries were not accompanied by any significant sequelae in the rat. From this threshold and colonic temperature (41.5°C for 30 min) in barbiturate-anesthetized, miccrowave-exposed rats, we derived a tentative threshold for the whole-body average absorption rate at 14 W/kg (70 mW/cm^2 at 2.45 GHz for adult rats) for 4 hr. This tentative threshold is subject to changes by duration of exposure and by compounding variables influencing maintenance of body temperature.

57 HEALTH AND SAFETY

6724 **(SAND—83-2464C) Polyvinylchloride (PVC) pipe hazards.** (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 18p. NTIS, PC A02/MF A01. Order Number DE84003249.

PVC pipe should be used only for low pressure liquid systems where the liquid is at or near ambient temperature. PVC pipe, because of its brittle nature, should be used only in unmanned areas or where it is isolated from personnel. It should be otherwise protected so that it is not subjected to ultraviolet light, temperature cycling or damage after installation. Heat (particularly welding and cutting) should be avoided in the immediate vicinity of the piping. PVC pipe should not be used where it would be subject to vibration. The effects of certain chemicals on PVC should be carefully considered, both where the pipe is a carrying medium for the chemical and where the pipe may be exposed to the chemicals externally.

6725 **(RFP-Trans—419) Dangerous chemical reactions. 71. Thorium, uranium, plutonium.** Leleu, J. Translated from *Cahiers de Notes Documentaires ;* No. 98, 139-141(1980). Contract AC04-76DP03533. 6p. NTIS, PC A02/MF A01. Order Number DE84002602. DE84002602

Brief notes are presented on the ignition, combustion, and reactions of Th, U, and Pu. (DLC)

58 GEOSCIENCES

REFER ALSO TO CITATION(S) 5886

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 5793, 5802, 6338, 6339

6726 **(BMI/OCRD—4(2)) Geological and structural setting of the CSM/OCRD test site: CSM experimental mine, Idaho Springs, Colorado.** Hutchinson, R.M. (Colorado School of Mines, Golden (USA). Dept. of Geological Engineering). Sep 1983. Contract AC06-76RL01830;AC02-83CH10140. 49p. NTIS, PC A03/MF A01. Order Number DE84003907.

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This report is the second in a series describing research conducted by the Colorado School of Mines (CSM) for the Office of Crystalline Repository Development (OCRD) to determine the extent of blast damage in rock surrounding an underground opening. A special room, called the CSM/OCRD room, was excavated for the purpose of assessing blast damage in the rock around the room. Even though this mine is not proposed as a nuclear waste repository site, the instrumentation and methods of blast damage assessment developed in this project are applicable to proposed repository sites. In order to understand which instruments and techniques are most applicable and what types of fractures existed before blasting, a thorough description of the rock mass surrounding the room is necessary. This report describes the geologic history of the area surrounding the Colorado School of Mines' Experimental Mine. The purpose of the historical description is to explain the probable origin of faults, fractures, and joints that affect rock mass permeability around the excavation site. This report will also provide probable cause of original rock mass stress in existence prior to excavating the experimental room. Furthermore, it provides a basis for detailed mapping of the CSM/OCRD experimental room wall rock. 19 references, 19 figures.

6727 **(BMI/ONWI—515) Adjoint sensitivity theory for steady-state ground-water flow.** (INTERA Environmental Consultants, Inc., Houston, TX (USA)). Nov 1983. Contract AC06-76RL01830;AC02-83CH10140. 81p. NTIS, PC AA05/MF A01. Order Number DE84003335.

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In this study, adjoint sensitivity theory is developed for equations of two-dimensional steady-state flow in a confined aquifer. Both the primary flow equation and the adjoint sensitivity equation are solved using the Galerkin finite element method. The developed computer code is used to investigate the regional flow parameters of the Leadville Formation of the Paradox Basin in Utah and the Wolcamp carbonate/sandstone aquifer of the Palo Duro Basin in the Texas Panhandle. Two performance measures are evaluated, local heads and velocity in the vicinity of potential high-level nuclear waste repositories. The results illustrate the sensitivity of calculated local heads to the boundary conditions. Local velocity-related performance measures are more sensitive to hydraulic conductivities. The uncertainty in the performance measure is a function of the parameter sensitivity, parameter variance and the correlation between parameters. Given a parameter covariance matrix, the uncertainty of the performance measure can be calculated. Although no results are presented here, the implications of uncertainty calculations for the two studies are discussed. 18 references, 25 figures.

6728 **(CONF-8310199—3) Empirical analysis of meandering and flow characteristics in laboratory and natural channels.** Edgar, D.E.; Rao, A.R.;. (Argonne National Lab., IL (USA); Purdue Univ., Lafayette, IN (USA)). 1983. Contract W-31-109-ENG-38. 12p. NTIS, PC A02/MF A01. Order Number DE84003461.

From Rivers '83 symposium; New Orleans, LA, USA (24 Oct 1983).

A promising hypothesis relating meander geometry to basic flow hydraulics was presented by Anderson in 1967. Although he successfully applied his theory to a data set from 27 laboratory channels, a general verification of his proposed relationships has not been reported. Consequently, the applicability of his results to a larger set of both laboratory and field data was investigated. Regression analysis of data from 161 laboratory and natural meandering alluvial channels indicates that the fundamental relationship proposed by Anderson between the relative meander length ($\lambda/\sqrt{A}$) and Froude number is valid for the laboratory channels considered in this study. However, analysis of field data indicates very poor correlation between these variables. These deviations are discussed, and it is suggested that stream discharge, properties of the sediment found in the channel perimeter, and channel or valley slope are additional factors that influence meandering in natural alluvial channels. Alternative models developed to explain the origin and characteristics of meanders should incorporate these three geomorphic variables with hydraulic variables if the models are to be applicable to the field situation. 24 references, 2 figures, 2 tables.

6729 (INIS-BR—78, pp 14) **Quality dependence of ESR dating of biological fossil samples.** Baffa Filho, O.; Mascarenhas, S. 1982. NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

6730 (LA—9907-OBES, pp 209-214) **Petrified Paleocene peat of Fort Union group of North Dakota.** Ting, F.T.C. (West Virginia Univ., Morgantown). Oct 1983. NTIS, PC A11/MF A01. (CONF-8309131—).

From Mineral matter in peat workshop; Los Alamos, NM, USA (26 Sep 1983).

Permineralization of Paleocene peat by silica in the Fort Union group in western North Dakota is the only known occurrence of silicified peat in the contiguous US. The silicified peat occurs as continuous beds or lenses containing well-preserved plant structures and plant remains characteristic of Paleocene peat-forming plant assemblage. The widespread and singular occurrence of the petrified lignite layer suggests a single event, pointing more logically to a volcanic ash origin or the result of a large influx of siliceous material. Regardless of the origin of the silicification, the restricted stratigraphic occurrence of this petrified bed renders it a superb marker bed for the lower boundary of the Sentinel Butte Formation with the underlying Tongue River Formation, which together form the Fort Union group. 9 references, 1 figure.

5802 Geophysics

6731 (CONF-830805—61) Combination of earthquake direction effects. Morrone, A. (Westinghouse Electric Corp., Madison, PA (USA). Advanced Energy Systems Div.). 1983. Contract AC15-76CL50003. 18p. NTIS, PC A02/MF A01. Order Number DE84001848.

From 7. international conference on structural mechanics in reactor technology; Chicago, IL, USA (22 Aug 1983).

The correct application of the square root of the sum of the squares (SRSS) rule is presented for obtaining the combined responses of a subsystem to seismic excitations given by orthogonal earthquake components represented by system response spectra. Alternate methods of applying the SRSS, which are sometimes used either for simplicity or due to different interpretation, are evaluated and compared with the correct method. The evaluations consider the following four cases: (1) the correct method which combines the responses in a particular direction given by each earthquake component as a last step, (2) a generally unconservative method whereby both the system response spectra and the resulting subsystem responses are combined by the SRSS, (3) a method which can be unconservative for unequal earthquake components where the system response spectra are combined by the absolute sum and the resulting responses by the SRSS, and (4) a conservative method which combines the system response spectra by the SRSS but adds the resulting responses absolutely. In addition, three conditions of directional coupling are considered for all cases. These are full directional coupling, only the system coupled, and no coupling. A comparison of the subsystem combined responses with the various SRSS methods is presented in tabular form which gives the applicable equations for each case and coupling condition.

6732 (INIS-mf—8223) Earthquakes in the Federal Republic of Germany 1977. (Seismologisches Zentralobservatorium Graefenberg, Erlangen (Germany, F.R.)). 1982. 49p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704622.

The seismic data will serve as input parameters for the construction of sensitive industrial-scale facilities and also as basic data of the general specifications for building construction (DIN 4149, part 1: Building construction in seismic regions of West Germany; assumed loads, dimensioning and design of high structures). To give a better picture, the data are presented in the form of maps showing seismic regions in West Germany (including marginal regions) and world-wide. Definitions are presented in order to facilitate reading for non-experts.

6733 (INIS-mf—8584, pp 74-77) **Application of X-ray fluorescence analysis in well logging.** Cechak, T.; Dana, J. [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

X-ray fluorescence analysis can be used for studying all elements with atomic number greater than 24. Most suitable is the use of a pair of balanced differential filters for improving resolution and a probe with a dual proportional detector. Using such a system, element concentrations lower than 0.1% can be detected. Drill experiments use two- or three-channel analyzers and other electronic equipment for processing differences and ratios of measured pulse rates. If lower resolution is sufficient for elements to be determined, the so-called point evaluation of the quantitative element occurence is used. The energy spectrum is measured at one point and the result is compared to standard spectra. A multi-channel analyzer is used for the measurement.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 5785, 5797, 5800

6734 (DOE/ER/10361—4) Mechanical and transport properties of rocks at high temperatures and pressures. Task III. Mechanical properties of rocks at high temperatures and pressures. Technical progress report Number 4, 1 March 1983-31 October 1983. Friedman, M.; Handin, J.; Bauer, S.J. (Texas A and M Univ., College Station (USA). Center for Tectonophysics). Nov 1983. Contract AS05-79ER10361. 13p. NTIS, PC A02/MF A01. Order Number DE84003438.

With regard to the preliminary conclusions about borehole stability in crystalline rocks at low confining pressures but high temperatures: (1) the creep-rupture strength of granite is only about 20 percent below the short-time triaxial-compressive strength so that for geotechnical applications, the effect of time may be ignored; and (2) the frictional strength at least of smooth surfaces in granite is only about half of the intact strength, so that a jointed rock-mass probably cannot be treated as a continuum and borehole failure by shear on those pre-existing fractures with high resolved shear stresses may occur at considerably shallower depths than that predicted for unjointed rock. With regard to fracture as a thermally-activated process, the tensile strength of granite drops from anout 10 MPa at 25°C to sensibly zero at 800°C.

5804 Geochemistry

REFER ALSO TO CITATION(S) 5783, 6292, 6345

6735 (DOE/EV/13573—T2) Trace elements and radionuclides in the Connecticut River and Amazon River estuary. Dion, E.P. (Yale Univ., New Haven, CT (USA). Dept. of Geology and Geophysics). 1983. Contract AC02-76EV13573. 252p. NTIS, PC A12/MF A01. Order Number DE84003668.

Thesis.

The Connecticut River, its estuary, and the Amazon River estuary were studied to elucidate some of the processes which control river water chemistry and the flux of elements to the sea. The approach taken was to identify inputs to the Connecticut River and to investigate geochemical processes which modify the dissolved load. The form and quantity of nuclides which are in turn supplied to the estuary are altered by processes unique to that transition zone to the ocean. The Connecticut River estuary was sampled on a seasonal basis to investigate the role of the estuary in controlling the flux of elements to the sea. The knowledge gained from the Connecticut River study was applied to the quantitatively more significant Amazon River estuary. There a variety of samples were analyzed to understand the processes controlling the single greatest flux of elements to the Atlantic Ocean. The results indicate that estimates of the total flux of nuclides to the oceans can best be calculated based on groundwater inputs. Unless significant repositories for nuclides exist in the river-estuarine system, the groundwater flux of dissolved nuclides is that which will eventually be delivered to the ocean despite the reactions which were shown to occur in both rivers and estuaries. 153 references, 63 figures, 28 tables.

6736 (INIS-mf—8248) Geochemical and isotope-geochemical investigations on thermal waters from the Urach-Kirchheim thermal anomaly. Koller, B. (Tuebingen Univ. (Germany, F.R.). Geowissenschaftliche Fakultaet). 10 Jun 1980. 140p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83704623.

Thesis.

To confirm possible circulation systems, the $^{18}O/^{16}O$ D/H isotope conditions of the surface waters and the thermal waters in the investigation area were determined. The circulation systems are due to crosswise anomalies, the geologic situation and a trough-shaped lowering of the permianbeds. A decisive influence of meteoric water could not be detected. A depletion in ^{18}O with increasing depth was established. Obviously, there has been interaction with water. The applicability of chemical thermometers was tested.

5805 Oceanography

6737 **(N—8326122) Fleet Admiral S. Gorshkov on study, uses of oceans.** Gorshkov, S. (Joint Publications Research Service, Arlington, VA (USA)). Apr 1983. 15p. NTIS, PC A06.

In USSR report: Earth Sci., No. 25 (JPRS-83261) p 34-48 (SEE N83-26119 15-42). Translated from Morsk. Sb. (Moscow); No. 12, 16-26(Dec 1982).

The use of oceans is discussed. The military and economic exploitation of oceans is emphasized. The failure of the United States to sign the Law of the Sea Convention is attacked. Areas of research such as hydrochemistry, underwater acoustics, geophysics, ocean thermal energy conversion, ocean models, and underwater resources are discussed.

64 PHYSICS. I.

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 6872, 6873

6738 **(INIS-mf—8681) Nonlinearity and instability in stellar coronae.** Martens, P.C.H. (Rijksuniversiteit Utrecht (Netherlands)). 10 Jan 1983. 164p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE84700520.

This thesis is mainly concerned with time dependent processes occurring in the hot and teneous plasma - about 1 million degrees and higher and less than 10^{10}cm density - that forms the outer envelopes of many stars including the sun. These envelopes - coronae - emit X-rays and indirectly in the ultraviolet and are therefore mainly observed by satellite techniques. Part I consists of a general introduction to the work and an overview of the nonlinear methods that are used in the following. Part II and part III are concerned with respectively open and closed coronal structures. There is great similarity in the physics of these two systems, but the open structures are somewhat more complicated.

6739 **(INIS-mf—8682) Some observational aspects of compact galactic X-ray sources.** Heise, J. (Rijksuniversiteit Utrecht (Netherlands)). 15 Dec 1982. 249p. NTIS (US Sales Only), PC A11/MF A01. Order Number DE84700521.

This thesis contains the following observations of compact galactic X-ray sources: i) the X-ray experiments onboard the Astronomical Netherlands Satellite ANS, ii) a rocket-borne ultra soft X-ray experiment and iii) the Objective Grating Spectrometer onboard the EINSTEIN observatory. In Chapter I the various types of compact galactic X-ray sources are reviewed and put into the perspective of earlier and following observations. In Chapter II the author presents some of the observations of high luminosity X-ray sources, made with ANS, including the detection of soft X-rays from the compact X-ray binary Hercules X-1 and the "return to the high state" of the black hole candidate Cygnus X-1. Chapter III deals with transient X-ray phenomena. Results on low luminosity galactic X-ray sources are collected in Chapter IV.

6740 **(LA-UR—83-3217) Stability of the low degree five minute solar oscillations.** Kidman, R.B.; Cox, A.N. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 10p. (CONF-8308136—2). NTIS, PC A02/MF A01. Order Number DE84003786.

From Solar seismology from space conference; Snowmass, CO, USA (17 Sep 1983).

In this paper we discuss the decay rate for many of the low degree p modes observed as 5 minute oscillations of the sun. This report is an expanded version of the presentation at Snowmass. These theoretical results use the completely nonadiabatic linear theory of Saio and Cox (1980). Our solar model is based on the evolution results of Christensen-Dalsbgaard (1982). Equation of state and opacity data come from the Los Alamos Opacity Library of Huebner, Merts, Magee, and Argo (1977). We compute rates for modes ranging from radial ($l = 0$) to the nonradial ones with $l = 5$ for overtones 10 through 28.

6741 **Turbulent generation of outward-traveling interplanetary Alfvenic fluctuations.** Matthaeus, W.H.; Goldstein, M.L.; Montgomery, D.C. (Department of Physics, The College of William and Mary, Williamsburg, Virginia 23185). *Physical Review Letters;* **51**: No. 16, 1484-1487(17 Oct 1983). Contract AS05-76ET53045.

From an analysis of magnetohydrodymic turbulent processes, the authors conclude that the frequent observation of outward-propagating Alfvenic fluctuations in the solar wind can arise from early stages of in situ turbulent evolution, and need not reflect coronal processes as has hitherto been assumed.

6742 **Experimental tests of the "invisible" axion.** Sikivie, P. (Physics Department, University of Florida, Gainesville, Florida 32611). *Physical Review Letters;* **51**: No. 16, 1415-1417(17 Oct 1983). Contract AS05-81ER40008.

Experiments are proposed which address the question of the existence of the "invisible" axion for the whole allowed range of the axion decay constant. These experiments exploit the coupling of the axion to the electromagnetic field, axion emission by the sun, and/or the cosmological abundance and presumed clustering of axions in the halo of our galaxy.

6743 **Star formation within OB subgroups: Implosion by multiple sources.** Klein, R.I.; Sanford, M.T. III; Whitaker, R.W. (Lawrence Livermore National Laboratory, and Department of Astronomy, University of California, Berkeley). *Astrophysical Journal, Letters to the Editor;* **271**: No. 2, L69-L73(15 Aug 1983). Contract W-7405-ENG-48.

We present the results of new detailed two-dimensional radiation-hydrodynamical calculations of the effects of radiation-driven shock waves from two O stars on inhomogeneities embedded in molecular clouds. The calculations indicate the neutral primordial clumps of gas with 84 M/sub sun/ can be highly compressed in 3 x 10^4 yr with density enhancements greater than 170 over ambient densities and 40 M/sub sun/ remaining. Inhomogeneities that are compressed in this manner by stars in the range O7—B0 survive ionization evaporation and may rapidly form new stars. Low-mass objects would not survive, and there would be a natural cutoff of low-mass and high-mass stars. We present a scenario for hierarchical radiation-driven implosion as a potential, new highly efficient mechanismfor star formation that may explain aspects of recent observations of new star formation in ultracompact H II regions.

6744 **Cygnus X-1: Optical variation on the 294 day X-ray period.** Kemp, J.C.; Barbour, M.S.; Henson, G.D.; Kraus, D.J.; Nolt, I.G.; Radostitz, J.V.; Priedhorsky, W.C.; Terrell, J.; Walker, E.N. (Department of Physics, University of Oregon). *Astrophysical Journal, Letters to the Editor;* **271**: No. 2, L65-L68(15 Aug 1983).

The recently discovered 294 day X-ray period has optical counterparts. A 10 yr B band photometric record shows synthronous changes of 0.01 mag amplitude, with minima coinciding with the X-ray minima. Stronger and weaker variations, respectively, are seen in U and V. The 5.6 day orbital light curves, additionally, show pronounced changes on the 294 day cycle. There is also a 294 day polarization variation.

6745 **X-ray sources and pulsars.** Truemper, J. (Max-Planck-Institut fuer Physik und Astrophysik, Garching (Germany, F.R.). Inst. fuer Extraterrestrische Physik). pp 7-30 of Cosmology and relativistic astrophysics. Hamburg, Germany, F.R.; Astronomische Gesellschaft (1983). (In German)(CONF-830392—No.58).

From Spring meeting for extraterrestrial physics of the Astronomische Gesellschaft and Constance symposium on cosmology and relativistic astrophy; Konstanz, F.R. Germany (22 Mar 1983).

Neutron stars give rise to a variety of phenomena in the X-ray sky. One can distinguish at least five different classes of sources: Nonthermal high energy emission from radio pulsars, thermal radiation from cooling neutron stars, pulsating sources in binary systems, X-ray and γ-ray burst sources. Observational results and their astrophysical interpretation are reviewed.

6746 Cosmological relevance of light element abundances. Mezger, P.G.; Schmid-Burgk, J. (Max-Planck-Institut fuer Radioastronomie, Bonn (Germany, F.R.)). pp 31-45 of Cosmology and relativistic astrophysics. Hamburg, Germany, F.R.; Astronomische Gesellschaft (1983). (CONF-830392—No.58).

From Spring meeting for extraterrestrial physics of the Astronomische Gesellschaft and Constance symposium on cosmology and relativistic astrophy; Konstanz, F.R. Germany (22 Mar 1983).

Of all the light elements produced in big bang nucleosynthesis, the primordial abundance of ^{4}He is cosmologically probably of the highest relevance. The present value of Ysub(p) as given by eq. (11) favors strongly the hot, isotropic and homogeneous "standard big bang model", as pointed out already by Doroshkevitch et al. (1971). The estimated upper range of Ysub(p) is compatible with three, at the utmost four, fermian families of elementary particles. Isotopic abundances of ^{2}H and ^{3}He favor a wide-open universe provided only baryons contribute to its mass. However, if neutrinos have rest masses proportional20-30 eV, they can close the universe without affecting the primordial light element abundances.

6747 Nuclear forces and the equation of state of supernova matter. Hartmann, D.; El Eid, M.; Barranco, M. pp 99-100 of Cosmology and relativistic astrophysics. Hamburg, Germany, F.R.; Astronomische Gesellschaft (1983). (CONF-830392—No.58).

From Spring meeting for extraterrestrial physics of the Astronomische Gesellschaft and Constance symposium on cosmology and relativistic astrophy; Konstanz, F.R. Germany (22 Mar 1983).

6748 Observational constraints on the thermonuclear flash model for gamma-ray bursts. Ventura, J. (Tuebingen Univ. (Germany, F.R.). Lehrstuhl fuer Theoretische Astrophysik); Bonazzola, S. (Observatoire de Paris, Section de Meudon, 92 (France)); Hameury, J.M.; Heyvaerts, J. (Centre National de la Recherche Scientifique, 75 - Paris (France). Inst. d'Astrophysique). pp 111-112 of Cosmology and relativistic astrophysics. Hamburg, Germany, F.R.; Astronomische Gesellschaft (1983). (CONF-830392—No.58).

From Spring meeting for extraterrestrial physics of the Astronomische Gesellschaft and Constance symposium on cosmology and relativistic astrophy; Konstanz, F.R. Germany (22 Mar 1983).

6749 e^+e^- production and annihilation in strong magnetized plasma. Wunner, G.; Herold, H.; Lauer, J.; Ruder, H.; Ventura, J. (Tuebingen Univ. (Germany, F.R.). Lehrstuhl fuer Theoretische Astrophysik). pp 115 of Cosmology and relativistic astrophysics. Hamburg, Germany, F.R.; Astronomische Gesellschaft (1983). (In German)(CONF-830392—No.58).

From Spring meeting for extraterrestrial physics of the Astronomische Gesellschaft and Constance symposium on cosmology and relativistic astrophy; Konstanz, F.R. Germany (22 Mar 1983).

6750 Radiation of accreting magnetized neutron stars: Photon diffusion in the accretion column. Soffel, M.; Herold, H.; Ruder, H.; Ventura, J. (Tuebingen Univ. (Germany, F.R.). Lehrstuhl fuer Theoretische Astrophysik). pp 116-117 of Cosmology and relativistic astrophysics. Hamburg, Germany, F.R.; Astronomische Gesellschaft (1983). (In German)(CONF-830392—No.58).

From Spring meeting for extraterrestrial physics of the Astronomische Gesellschaft and Constance symposium on cosmology and relativistic astrophy; Konstanz, F.R. Germany (22 Mar 1983).

6751 Cosmology and relativistic astrophysics. Hamburg, Germany, F.R.; Astronomische Gesellschaft (1983). vp. (In German). (CONF-830392—No.58). Bochum Univ. (Germany, F.R.). Astronomisches Inst.

From Spring meeting for extraterrestrial physics of the Astronomische Gesellschaft and Constance symposium on cosmology and relativistic astrophy; Konstanz, F.R. Germany (22 Mar 1983).

The papers presented were entered into the data base separately. (WHK)

6752 Dust-lanes in elliptical and lenticular galaxies. Sharples, R.M. Edinburgh, Scotland; Edinburgh University (1982). 223p. British Library, Boston Spa, Wetherby, West Yorks. No. D44326/83.

Thesis.

Some elliptical and lenticular galaxies show evidence of well-defined dust-lanes when examined on deep survey plates. New near-infrared (JHK) observations of 46 dust-lane galaxies are presented and compared with those for a sample of 24 morphologically normal systems. Infrared excesses are found preferentially in galaxies which exhibit at least weak signs of a stellar disc; the physics of the emission mechanism is discussed. New optical spectra are also discussed. A restricted sample of 'elliptical-like' galaxies with dust-lanes, but containing no significant luminous disc, has been defined. These galaxies cannot be distinguished from a comparable sample of morphologically normal ellipticals on the basis of UBV colours or luminosity. Four examples have been selected for a detailed study of their structure and dynamics. Rotation curves and velocity dispersion profiles have been derived from long-slit spectra using Fourier analysis techniques; surface photometry was obtained from large-scale photographic plates. In three cases the angular momentum axis of the dust-lane is different from that of the stellar component, favouring an external origin for the dust and gas. Two of the galaxies rotate as rapidly as oblate models with isotropic velocity dispersions.

6753 Shock waves in supernova remnants. Bosch, J.B. Oxford, England; Oxford University (1981). 281p. British Library, Boston Spa, Wetherby, West Yorks. No. D44163/83.

Thesis.

Several problems relating to the structure of supernova remnants are discussed. The optical component is considered in some detail, including the evolution of the abundance-dependent line ratio I(Hsub(α))/I(NII). X-ray and radio observations are also considered. The structure of shock waves in an unmagnetised plasma is discussed. The collisional case is solved by assuming quasi-neutrality and neglecting heat transfer between electrons and ions. A collisionless model is presented in which the main dissipative processes are the beam and the drift instabilities. It is suggested that the shock waves occuring in young supernova remnants are mixed structures. At the leading edge of the shock classical electron viscosity rapidly dissipates the initial electron kinetic energy. This is followed by the collisionless processes, which will dissipate most of the plasma kinetic energy. Electron heating is not properly taken into account in this model, and only the rapid deceleration of this component can be reproduced. This occurs over a distance that is so short that the ion response is insignificant.

6754 Position encoding for imaging X-ray detectors. Fraser, G.W. Leicester, England; Leicester University (1980). 332p. British Library, Boston Spa, Wetherby, West Yorks. No. D42902/82.

Thesis.

A theoretical account is given of methods of electronic position encoding based on RC lines and resistive anode readout elements. The work was undertaken to support the development of imaging X-ray detectors for cosmic X-ray astronomy; other fields of possible application are noted. A brief review of imaging and non-imaging detectors used in X-ray astronomy is followed by a detailed account of the current generation of position-sensitive X-ray detectors and their associated readout elements. The standing of RC line and resistive anode readout in relation to other commonly-used systems is established. Quantitative descriptions of the non-linearity and resolution performance of capacitively-terminated RC lines using both amplitude ratio (charge division) and difference zero-cross time methods are given. The predictions of a series of calculations are compared with results from an extensive experimental programme. Optimum line configurations are defined. Calculations of the distortion and resolution performance of both square and circular resistive anode position encoders are presented. A numerical method is employed to solve the relevant potential problems in the limit of vanishing anode capacitance, allowing amplitude ratio methods to be examined in a number of electrode configurations. Analytical approximations permit the examination of two-dimensional zero-cross timing using resistive anodes. The prop-

erties of two alternative readout elements - Gear's anode and the four-quadrant anode - are discussed in relation to the performance of uniform resistive anodes. Finally, a possible application of the work reported here to the design of a future satellite experiment is discussed.

6402 Atmospheric Physics

6755 **(N—8326333) Eddy intrustion of hot plasma into the polar cap and formation of polar-cap arcs.** Chiu, Y.T.; Gorney, D.J. (Aerospace Corp., El Segundo, CA (USA)). May 1983. 25p. (NASA-CR—170377). NTIS, PC A02/MF A01.

Under the simple postulate that multiple large scale detachable magnetospheric convection eddies can exist in the vicinity of the convection reversal boundary and in the polar cap, by Kelvin-Helmholtz instability or otherwise, it is shown that a number of seemingly disconnected plasma and electric field observations in the polar cap can be organized into a theory of magnetosheath and plasmasheet plasma intrusion into the polar cap. Current theory of inverted V structures then predicts existence of similar, but weaker, structures at the eddy convection reversal boundaries in the polar cap. A possible consequence is that the polar cap auroras are natural offshoots from discrete oval arcs and evidently are formed by similar processes. The two arc systems can occassionally produce an optical image in the form of the theta aurora.

6756 **(N—8327519) Relationships between field-aligned currents, electric fields and particle precipitation as observed by dynamics Explorer-2.** Sugiura, M.; Iyemori, T.; Hoffman, R.A.; Maynard, N.C.; Burch, J.L.; Winningham, J.D. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). May 1983. 25p. (NASA-TM—85025). NTIS, PC A02/MF A01.

The relationships between field-aligned currents, electric fields, and particle fluxes are determined using observations from the polar orbiting low-altitude satellite Dynamics Explorer-2. It is shown that the north-south electric field and the east-west magnetic field components are usually highly correlated in the field-aligned current regions. This proportionality observationally proves that the field-aligned current equals the divergence of the height-integrated ionospheric Pedersen current in the meridional plane to a high degree of approximation. As a general rule, in the evening sector the upward field-aligned currents flow in the boundary plasma sheet region and the downward currents flow in the central plasma sheet region. The current densities determined independently from the plasma and magnetic field measurements are compared. Although the current densities deduced from the two methods are in general agreement, the degree and extent of the agreement vary in individual cases.

6757 **Plasma concentrations and temperatures in the earth's mid- to low latitude F-region and plasmasphere.** Footitt, R.J. Sheffield, England; Sheffield University (1981). 390p. British Library, Boston Spa, Wetherby, West Yorks. No. D42456/82.

Thesis.

Two methods are developed for providing reliable values of plasma concentration, field - aligned velocity and temperature. They are used to investigate certain ionospheric phenomena. The first of the two methods is appropriate to mid- latitude studies; here magnetic field lines may be assumed straight which greatly simplifies calculations. The second method is appropriate to low latitude studies where the curvature of magnetic field lines must be taken into account.

6758 **Magnetospheric studies with suprathermal plasma analysers on the ESA GEOS satellites.** Johnson, J.F.E. London, England; London University (1980). 335p. British Library, Boston Spa, Wetherby, West Yorks. No. D70168/81.

Thesis.

Following a brief description of the current state of magnetospheric research and the relation of the GEOS spacecraft to the IMS (International Magnetospheric Study), the importance of suprathermal plasma measurements is explained. Both of the GEOS spacecraft included in their comprehensive set of wave and particle detectors a Suprathermal Plasma Analyser (SPA), which measures differential fluxes of electrons and positive ions in the energy range 0.5 eV to 500 eV. The design philosophy behind the SPA, as determined by both scientific objectives and by difficulties of differential measurements at such low energies, is described in detail; a number of novel and previously untried features included to overcome these difficulties are shown to be largely successful. A comparison is made between the theoretical model of the instrument response and laboratory calibrations. The contribution of the SPA data to magnetospheric research is summarised, and suggestions for further study are outlined.

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 6353, 6948

6759 **(CONF-830706—8) Learning from numerical calculations of ion-atom collisions.** Reading, J.F.; Ford, A.L.; Smith, J.S.; Becker, R.L. (Texas A and M Univ., College Station (USA). Dept. of Physics; Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 11p. NTIS, PC A02/MF A01. Order Number DE84003265.

From 13. international conference on the physics of electronic and atomic collisions (ICPEAC); Berlin, F.R. Germany (27 Jul 1983).

A report on the progress in coupled channel methods applied to ion-atom collisions is presented. A new approximation scheme for collisions with correlated atoms is described and tested.

6760 **(DOE/ER/04971—5) Energy-related atomic and molecular structure and scattering studies. Annual progress report, January 1, 1983-December 31, 1983.** Bederson, B. (New York Univ., NY (USA). Dept. of Physics). 1983. Contract AC02-78ER04971. 6p. NTIS, PC A02/MF A01. Order Number DE84003172.

We summarize work done in our laboratory on DOE-sponsored research, and also summarize other activities of our group. Detailed presentations of our current interests and future plans are presented in the accompanying Renewal Proposal. In the polarizability experiment, we have completed measurements of the dc electric dipole polarizabilities of all alkali halide dimers. We have completed the experiment to measure the dc electric polarizability of atomic indium. Similar measurements on several thallous halides are in progress. In our scattering work, the construction phase on our new apparatus has been completed, and we have now finished the first measurements of absolute cross sections for the scattering of low energy electrons by five highly polar systems (alkali halides), and have also done some preliminary measurements on similar studies on one alkali halide), and have also done some preliminary measurements on similar studies on one alkali halide dimer.

6761 **(INIS-mf—8247) Delta electron spectroscopy for the study of the inner-shell excitation in heavy ion collisions.** Trollmann, G. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Physik). 22 Jul 1981. 89p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83704606.

Thesis.

In this thesis energy and angular differential cross sections of delta electrons from ion-atom collisions are measured and compared with different perturbation theories. Shell specific cross sections were obtained from electron-X-ray coincidences. Contradicting theoretical statements concerning the angular distribution of the electrons can be experimentally clarified, other predictions are verified. Starting from fast, strongly asymmetric collisions until to slow, more symmetric collisions the question of the disturbance of the stationary target state by the projectile and the formation of intermediate molecular state is studied. With the results of the measurement of the delta electrons it can be contributed to the clarification of the question for the physical origin of the continuous X-radiation in the energy range beyond the K-line of the heavier collision partner. It is shown that the secondary electron bremsstrahlung discussed as radiation source besides the molecular orbital (MO) radiation is in its intensity about more than one order of magnitude

weaker than the measured X-radiation and is therefore excluded as dominant radiation. In the framework of this work an apparature was developed, which allows the electron spectroscopy in the energy range between 10 keV and 150 keV and the angular range between 5 degrees and 180 degrees for the absolute determination of double differential cross sections.

6762 (INIS-mf—8536, pp 61) **Positrons annihilation in electrolytes systems.** Millan, S. (Instituto Nacional de Investigaciones Nucleares, Mexico City); Zana, R.; Abbe, J.C.; Duplatre, G. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). 1982. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).

Published in summary form only.

6763 **(INIS-mf—8598) Study of the angular distribution of the electrons in the peak near vsub(e)=vsub(i) in the electron spectra from He^+, H_2^+ - Ar collisions.** Koever, A.; Varga, D.; Szabo, Gy.; Berenyi, D.; Kadar, I.; Ricz, S.; Vegh, J.; Hock, G. (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete). 1983. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704607.

The peak near vsub(e)=vsub(i) in the electron spectra from He^+ (0.8 MeV/amu), H_2^+ (0.8 MeV/amu; 1.995 MeV/amu) - Ar collisions was studied at thirteen angles from 0 deg to 180 deg. The experimental values for the position and half width (FWHM) of these peaks were compared with theoretical calculations. An example is given for the comparison of the actual shapes of the peak for different projectiles with the corresponding theoretical curves. The angular distribution of the electrons in the electron loss peak (i.e. the single differential cross section) was plotted together with the theoretical ones.

6764 **(INIS-mf—8599) Angular distribution of electrons and X-rays from high energy ion-atom collisions.** Berenyi, D. (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete). 1983. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704608.

Recent, partly preliminary results on angular dependence of the broad peak near vsub(e)=vsub(i) and Auger electrons in the spectrum of electrons emitted in high energy ion-atom collisions are given for different projectiles (H^+, H_2^+, He^+, Ne^{3+}, Ne^{10+}, with impact energies from 0.8 to 112 MeV) and targets (Ar,Ne), resp. The angular distribution of L X-rays from H^+, He^+, C^+, N^+ and Ne^+ impact (ion energies from 0.2 to 18.2 MeV, resp.) on Au was studied and the alignment parameter determined.

6765 **(INIS-mf—8600) L-shell ionization.** Sarkadi, L. (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete). 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704609.

A brief review of the most important features of the L-shell ionization of atoms by charged particle impact is given. It is shown that the direct Coulomb theories successfully describe the ionization processes as far as the perturbing effect of the projectile is small. For stronger perturbations induced by low velocity heavy ions, however, serious disagreement has been observed between the experimental cross section data and the theoretical predictions which indicates, among others, the failure of the hypothesis of the independent ionization of the individual atomic L sublevels.

6766 **(INIS-mf—8669) Multiple ionization effects due to recoil in atomic collisions.** Vegh, L. (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete). 1983. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700516.

A description of atomic recoil excitation caused by the projectile nucleus is given using the two-potential formula. The relation of the direct and recoil ionization amplitudes are discussed demonstrating that their interference in dipole approximation may be destructive only approximately. The recoil mechanism can produce strong multiple ionization and the strength of the satellite lines follows strictly the binomial distribution. The recoil ionization in neutron induced reactions, the life-time of the inner-shell vacancy in recoiled ions and the recoil effects in the electron conversion coefficients are discussed.

6767 (INIS-mf—8672, pp 56) **Investigation of photon emission due to electron capture excitation in collisions of light ions with lithium atoms.** Aumayr, F.; Brazuk, A.; Wutte, U.; Winter, H. (Technische Univ., Vienna (Austria). Inst. fuer Allgemeine Physik); Dijkkamp, D.; Heer de, F.J. (FOM-Instituut voor Atoom-en Molecuulfysica, Amsterdam (Netherlands)); Drentje, A. (Rijksuniversiteit Groningen (Netherlands)). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6768 (INIS-mf—8672, pp 119) **Ion-neutral (atom) interactions at thermal energies.** Villinger, H.; Dobler, W.; Saxer, A.; Federer, W.; Richter, R.; Howorka, F.; Ferguson, E.E.; Durup-Ferguson, M.; Bryant, H.; Futrell, J. (Innsbruck Univ. (Austria). Inst. fuer Experimentalphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6769 (INIS-mf—8672, pp 57) **Optical excitation of N_2^+ in collisions with He, Ne, Ar and Xe in the 1-2000 eV energy range.** Howorka, F.; Kuen, I. (Innsbruck Univ. (Austria). Inst. fuer Experimentalphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6770 (INIS-mf—8672, pp 57) **Swarm experiment for the investigation of ion-neutral atom interactions.** Villinger, H.; Lindinger, W. (Innsbruck Univ. (Austria). Inst. fuer Experimentalphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6771 (INIS-mf—8672, pp 58) **Effect of chemical bonding of the F-Ksub(α) x-ray spectrum excited by 80 MeV and 48 MeV Mg ions.** Benka, O. (Johannes Kepler Univ., Linz (Austria). Inst. fuer Experimentalphysik); Watson, R.L. (Texas Univ. (United States of America). Cyclotron Inst.). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6772 (INIS-mf—8672, pp 59) **Measurement of the electron induced K-shell ionization cross sections in the energy range 0.5 to 2 MeV.** Unfried, W.; Viernstein, W.; Aiginger, H. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6773 (INIS-mf—8672, pp 59) **Analytical cross-section formula for the k shell ionization by protons.** Paul, H. (Johannes Kepler Univ., Linz (Austria). Inst. fuer Experimentalphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6774 (INIS-mf—8672, pp 60) **Enhancement at ion-backscattering on solids under 180°.** Golser, R.; Semrad, D. (Johannes Kepler Univ., Linz (Austria). Inst. fuer Experimentalphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6775 (INIS-mf—8672, pp 60) **Energy loss standards for Rutherford backscattering measurements.** Bauer, P.; Semrad, D. (Johannes Kepler Univ., Linz (Austria). Inst. fuer Experimentalphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6776 (INIS-mf—8672, pp 61) **Accurate measurements of positron lifetimes in Cd, In and Sn.** Puff, W.; Mascher, P.; Kindl, P.; Sormann, H. (Technische Univ., Graz (Austria). Inst. fuer Kernphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6777 (INIS-mf—8672, pp 87) **New findings on positron annihilation in polymers.** Breitenhuber, L.; Kindl, P.; Sormann, H.; Puff, W. (Technische Univ., Vienna (Austria). Inst. fuer Experimentelle Kernphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6778 (INIS-mf—8672, pp 75) **Collision induced light scattering from molecular gases.** Treitl, K.; Posch, H.A. (Vienna Univ. (Austria). Inst. fuer Experimentalphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6779 **(LBL—16296) Gas-phase photoemission with soft x-rays: cross sections and angular distributions.** Shirley, D.A.; Kobrin, P.H.; Truesdale, C.M.; Lindle, D.W.; Ferrett, T.A.; Heimann, P.A.; Becker, U.; Kerkhoff, H.G.; Southworth, S.H. (Lawrence Berkeley Lab., CA (USA)). Sep 1983. Contract AC03-76SF00098. 9p. (CONF-8310172—7). NTIS, PC A02/MF A01. Order Number DE84002900.

From Advances in soft x-ray science and technology conference; Upton, NY, USA (17 Oct 1983).

A summary is presented of typical gas-phase photoemission studies based on synchrotron radiation in the 50-5000 eV range, using beam lines at the Stanford Synchrotron Radiation Laboratory. Three topics are addressed: atomic inner-shell photoelectron cross sections and asymmetries, correlation peaks in rare gases, and core-level shape resonances in molecules.

6780 **(LBL—16298) Angle-resolved photoemission extended fine structure.** Barton, J.J.; Bahr, C.C.; Hussain, Z.; Robey, S.W.; Klebanoff, L.E.; Shirley, D.A. (Lawrence Berkeley Lab., CA (USA)). Sep 1983. Contract AC03-76SF00098. 9p. (CONF-8310172—8). NTIS, PC A02/MF A01. Order Number DE84002899.

From Advances in soft x-ray science and technology conference; Upton, NY, USA (17 Oct 1983).

Core level angle-resolved photoemission intensity oscillates sinusoidally with increasing photoelectron momentum. Interference between direct and scattered photo-emission causes this angle-resolved photoemission extended fine structure (ARPEFS). We will discuss an analytic single-scattering theory which quantitatively describes the oscillations. The procedures for extracting surface geometry information from photoemission measurements will be illustrated with S(1s) ARPEFS from S on Ni(100) and Cu(100) obtained with the soft X-ray double crystal monochromator at the Stanford Synchrotron Radiation Laboratory. Building on the surface sensitivity and chemical selectivity of photoemission, ARPEFS analysis provides direct geometrical information from the oscillation frequencies (derived with auto-regressive Fourier analysis), from intensity changes with polarization and analyzer position, and from analysis of scattering phase-shift zero-crossings.

6781 **(UCID—19902) Software for computer controlled x-ray photoelectron and auger spectroscopy.** Boyle, W.G. Jr. (Lawrence Livermore National Lab., CA (USA)). 22 Jun 1983. Contract W-7405-ENG-48. 67p. NTIS, PC A04/MF A01. Order Number DE84003912.

Portions are illegible in microfiche products.

X-ray photoelectron spectroscopy (XPS) and Auger spectroscopy measure the energy of electrons ejected from the atoms on a surface. The two spectroscopies have different means of excitation, and different mechanisms for electron ejection. A general purpose instrument, employing these techniques, has been developed to study surface phenomena. The software described in this document has been developed to allow an LSI-11/23 processor to control many of the instrumental parameters, acquire data, and transform them to a form that is transportable by diskette to a data processing system on another machine. Additional software provides a view of an elastic peak while experiments are being set up.

6782 **(UCRL—89433-Rev.1) Volume generation of negative ions in high density hydrogen discharges. Revision 1.** Hiskes, J.R.; Karo, A.M. (Lawrence Livermore National Lab., CA (USA)). 11 Nov 1983. Contract W-7405-ENG-48. 29p. (CONF-831180—7-Rev.1). NTIS, PC A03/MF A01. Order Number DE84003238.

From 3. international symposium on the production and neutralization of negative ions and beams; Upton, NY, USA (14 Nov 1983).

An optimized tandem two-chamber negative-ion source system is discussed. In the first chamber high energy ($E > 20$ eV) electron collisions provide for H_2 vibrational excitation, while in the second chamber negative ions are formed by dissociative attachment. The gas density, electron density, and system scale length are varied as independent parameters. The extracted negative ion current density passes through a maximum as electron and gas densities are varied. This maximum scales inversely with system scale length, R. The optimum extracted current densities occur for electron densities near $nR = 10^{13}$ electrons cm^{-2} and for gas densities, N_2R, in the range 10^{14} to 10^{15} molecules cm^{-2}. The extracted current densities are sensitive to the atomic concentration in the discharge. The atomic concentration is parametrized by the wall recombination coefficient, γ, and scale length, R. As γ ranges from 0.1 to 1.0 and for system scale lengths of one centimeter, extracted current densities range from 8.0 to 80. mA cm^{-2}.

6783 **Ab initio potential energy curves for the low-lying electronic states of the argon excimer.** Yates, J.H.; Ermler, W.C.; Winter, N.W.; Christiansen, P.A.; Lee, Y.S.; Pitzer, K.S. (Department of Chemistry and Chemical Engineering, Stevens Institute of Technology, Hoboken, New Jersey 07030). *Journal of Chemical Physics;* **79**: No. 12, 6145-6149(15 Dec 1983).

Configuration interaction calculations are reported for the potential energy curves of the argon excimer that arise due to excitation to the 4s and 4p Rydberg molecular orbitals. Effective core potentials were employed to replace the core electrons of the Ar atoms thereby reducing the computational procedure to one for a 16 valence system. Potential energy curves for three excimer states of each of the symmetries $^1\Sigma^+$/sub g/, $^1\Sigma^+$/sub u/, $^3\Sigma^+$/sub g/, $^3\Sigma^+$/sub u/, ^{1}Pi/sub u/, ^{3}Pi/sub u/, ^{1}Pi/sub g/, and ^{3}Pi/sub g/ are reported and compared with those previously computed. Spectroscopic constants and curve maxima are reported where appropriate.

6784 **Emission, optical—optical double resonance, and excited state absorption spectroscopy of matrix isolated chromium and molybdenum atoms.** Pellin, M.J.; Gruen, D.M.; Fisher, T.; Foosnaes, T. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Chemical Physics;* **79**: No. 12, 5871-5886(15 Dec 1983). Contract W-31-109-ENG-38.

Making use of a combination of time-resolved emission, optical—optical double resonance, and excited state absorption spectroscopy, it has been possible to assign virtually all spectral features with energies below the z^7P^0 state of matrix isolated Cr atoms. The a^5S state located at 7593 cm^{-1} in the free gaseous Cr atom has lifetimes of 6.32 and 5.1 s in Ar and Kr matrices, respectively. Matrix perturbations on Cr emission lines are small (< +- 100 cm^{-1}). The dependence of nonradiative decay rates on the local density of states is elucidated. The magnitude of matrix shifts for a particular transition is correlated with the electronic configurations of ground and excited states and it is pointed out that states having only "s" electrons in addition to "d" electrons maintain their gas phase energy relationships in the matrix environment. Direct fluorescence is observed from the z^7P^0 level of Mo to the ^7s ground state. The spin-orbit splitting of the "relaxed" z^7P^0 state is 690 cm^{-1}, slightly lower than the 707 cm^{-1} splitting of the free gaseous Mo atom.

6785 **Emission, ground, and excited state absorption spectroscopy of Cr_2 isolated in Ar and Kr matrices.** Pellin, M.J.; Gruen, D.M. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Chemical Physics;* **79**: No. 12, 5887-5893(15 Dec 1983). Contract W-31-109-ENG-38.

Irradiation into either of the two resonance transitions of Cr atoms in Kr matrices results in strong bleaching of the atomic absorptions and simultaneous growth of two Cr_2 dimer bands. The lower energy band of Cr_2 at ~470 nm is the well-known $^1\Sigma^+$/sub u/ → $^1\Sigma^+$/sub g/ transition. The higher energy band at ~340 nm we assign to the ^{1}Pi/sub u/ ← $^1\Sigma^+$/sub g/ transition which occurs at almost the same energy as, and is therefore obscured by, the y^7P^0 ← a^7S transition of normally present Cr atoms in Kr (and Ar) matrices. Laser induced fluorescence from the ~470 nm band gives a broad, featureless emission presumably because of extensive predissociation after cage relaxation of the excited $^1\Sigma^+$/sub u/ state. Emission after excitation of ^{1}Pi/sub u/ ← $^1\Sigma^+$/sub g/ transition yields a four member progression with spacing of ~240 cm^{-1}. The spectrum is consistent with emission from a $^3\Sigma$/sub g/ "trap" level to a lower lying $^3\Sigma$/sub u/ state, ~8000 cm^{-1} above ground. An energy level diagram of the Cr_2 molecule is presented which incorporates all of the spectroscopic information available on the dimer.

6786 **Formaldehyde: Ab initio MCSCF+CI transition state for H_2CO → CO+H_2 on the S_0 surface.** Dupuis, M.; Lester, W.A. Jr.; Lengsfield, B.H. III; Liu, B. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Chemical Physics;* **79**: No. 12, 6167-6173(15 Dec 1983).

Ab initio multiconfiguration self-consistent field (MCSCF) and configuration interaction (CI) calculations have yielded an activation energy of 80.9 +- 3.0 kcal/mol for the dissociation of formaldehyde to H_2 and CO on the ground state potential energy surface. The error limits are estimates based on an analysis of the effects of one-particle basis set, electron correlation, and transition state structure on the activation energy. Accurate structures and harmonic frequencies are presented for H_2CO ($X\ ^1A_1$) and the transition state.

6787 **Doublet→quartet and doublet→doublet electronic transitions in NO_2 by electron impact.** Rianda, R.; Frueholz, R.P.; Kuppermann, A. (Arthur Amos Noyes Laboratory of Chemical Physics, California Institute of Technology, Pasadena, California 91125). *Journal of Chemical Physics;* **79**: No. 12, 5914-5917(15 Dec 1983).

The electron-impact energy-loss spectrum of nitrogen dioxide (NO_2) has been measured at impact energies of 25, 50, and 75 eV, and scattering angles varying from 5° to 80°. A previously unreported spin-forbidden doublet→quartet transition was observed at 4.49 eV, in excellent agreement with theoretical calculations. Doublet→doublet transitions were observed at 2.95, 5.81, 7.48, 8.64, 9.69, 10.52, 10.68, 10.94, and 11.20 eV, in agreement with previous experimental and theoretical work. In addition, numerous doublet→doublet transitions to superexcited states were observed.

6788 **Accurate calculations of electrostatic potentials for cylindrically symmetric lenses.** Edwards, D. Jr. (Department of Chemistry, Brookhaven National Laboratory, Upton, New York 11973). *Review of Scientific Instruments;* **54**: No. 12, 1729-1735(Dec 1983).

Improved methods are described for determining electrostatic potentials within cylindrically symmetric lenses. At fixed number of mesh points, increases in the obtainable precision of approximately a factor of 100 are found by using the present relaxation method. This type of improvement in the precision implies decreases in computational times of a factor of ~ 10^4 when compared with previous relaxation techniques for equivalent precisions.

6789 **Excited-state lifetime measurements: Linearization of the Foerster equation by the phase-plane method.** Love, J.C.; Demas, J.N. (Department of Chemistry, University of Virginia, Charlottesville, Virginia 22901). *Review of Scientific Instruments;* **54**: No. 12, 1787-1789(Dec 1983). Contract FG02-80CS84063.

The Foerster equation describes excited-state decay curves involving resonance intermolecular energy transfer. A linearized solution based on the phase-plane method has been developed. The new method is quick, insensitive to the fitting region, accurate, and precise.

6790 **Atomic resolution observations of nonlinear depleted zones in tungsten irradiated with metallic diatomic molecular ions.** Pramanik, D.; Seidman, D.N. (Cornell University, Department of Materials Science and Engineering and the Materials Science Center, Ithaca, New York 14853-0121). *Journal of Applied Physics;* **54**: No. 11, 6352-6367(Nov 1983). Contract AC02-76ER03158.

Direct evidence, on an atomic scale, is presented for the enhancement of damage production per projectile ion in metallic diatomic molecular ion (dimer) irradiations of tungsten as compared to monatomic ion (monomer) irradiations. Irradiations were performed in situ at < or ≈10 K, in a field-ion microscope, employing 20 keV Ag^+ and W^+ ions and the results are compared with 40 keV W^+_2 and Ag^+_2 ion bombardments; the average energy per ion is 20 keV. The energy and mass of the dimers are such that the collision cascades are nonlinear. By directly counting the number of vacancies in individual depleted zones, produced by the different ions, it was demonstrated that the number of vacancies produced per incoming ion of the dimer is 1.55 times greater than the number of vacancies produced per monomer. The depleted zones produced in the near-surface region, by the W^+_2 dimers, give rise to void-like contrast effects. Whereas the W^+ monomers do not produce the void-like contrast of the W^+_2 ions. This result can only be understood if significant rearrangement of vacancies had occurred after the dynamic development of the collision cascade. The presence of voids is explained employing a nucleation and growth model. The average diameter (<λ>) of the depleted zones created by 20 keV Ag^+ and W^+ monomers is 17.5 A, while <λ> is 28.5 A for the Ag^+_2 and $W=_2$ dimers. Thus the depleted zones created by the dimers are larger than those produced by the monomers, but not twice as large.

6791 **Beam scanning for heavy charged particle radiotherapy.** Goitein, M.; Chen, G.T.Y. (Division of Radiation Biophysics, Department of Radiation Medicine, Massachusetts General Hospital, Boston, Massachusetts 02114 and Harvard Medical School). *Medical Physics;* **10**: No. 6, 831-840(Nov 1983). Contract W-7405-ENG-48.

An important aspect of heavy charged particle radiotherapy is its ability to localize dose to the target volume. Current techniques generally employ beam delivery schemes which use range modulated beams in which the Bragg peak is spread out over a range of depths. The range modulation is constant over the entire beam cross section. This paper examines the potential gain from the use of variable range modulation over the beam cross section which can be achieved through beam scanning. An analytic technique has been developed to calculate a gain factor, related to integral dose, for a number of different charged particle beams. The dependence of the gain factor on tumor depth, diameter, and size has been examined. These analytic results have been compared with computer

calculations of treatment plans simulating beam scanning and fixed modulation delivery techniques for actual clinical cases. The rationale for beam scanning, and its potential impact on tumor control is discussed.

6792 **X-ray spectral line coincidences between fluorine K- and transition-metal L-series lines.** Burkhalter, P.G.; Charatis, G.; Rockett, P.D. (Naval Research Laboratory, Washington, DC 20375). *Journal of Applied Physics;* **54**: No. 11, 6138-6149(Nov 1983). Contract AI08-79DP40092.

X-ray spectroscopy was performed in the 12—15-A region, recording L-series lines from selected laser-irradiated transition metals. Line coincidences and near coincidences were identified between Cr, Mn, Fe, and Ni L spectra, and F VIII and F IX K-shell lines. Wavelengths were determined to accuracies of 1—3 mA and will be utilized in selecting potential pumping candidates in future x-ray lasing schemes. High-resolution x-ray spectra were collected under controlled illumination and target conditions, using 1.05- and 0.527-μm laser excitation with the KMS CHROMA laser. Laser intensity varied from 1.2—2.5 x 10^{14} W/cm^2 in 200-ps pulses. Three groups of x-ray spectra were collected with highly dispersive x-ray crystals at wave bands centered at 12.643, 13.781, and 14.458 A, corresponding to H- and He-like lines from fluorine. Two specially designed flat crystal spectrographs employing camera shutters were used with pairs of beryl and thallium acid phthalate (TAP) crystals. The spectra from potential lasant and pump candidates could be recorded on the same spectrogram to aid in identifying x-ray line coincidences. In cases where wavelengths were measured in both the 1.05- and 0.527-μm laser work, agreement within 1—3 mA was obtained for the L-series x-ray lines. Within this accuracy range, some five L-series x-ray lines, mostly 2p-3d transitions from the metals Cr, Mn, and Ni, had wavelength values coincident with K-series lines in fluorine.

6793 **Multiple-ionization mechanisms in fast proton-neon collisions.** Manson, S.T.; DuBois, R.D.; Toburen, L.H. (Department of Physics and Astronomy, Georgia State University, Atlanta, Georgia 30303). *Physical Review Letters;* **51**: No. 17, 1542-1545(24 Oct 1983). Contract AC06-76RL01830.

New experimental and theoretical results are presented which, in conjunction with previous experiments, allow us to determine cross sections for each of the ionization pathways leading to Ne^+ and Ne^{+2} formation in $H^+ + Ne$ collisions in the 0.5—4 MeV range. It is found that multiple outer-shell ionization is far more probable than inner-shell ionization.

6794 **Lamb shift and the lifetime of the 2 ^{2}S/sub 1/2/ state of hydrogenlike argon (Z = 18).** Gould, H.; Marrus, R. (Materials and Molecular Research Division, Building 71-259, Lawrence Berkeley Laboratory, University of California at Berkeley, Berkeley, California 94720). *Physical Review [Section] A: General Physics;* **28**: No. 4, 2001-2025(Oct 1983).

We report a measurement of the Lamb shift in hydrogenlike argon based on the electric-field-quenching method, and a measurement of the unperturbed lifetime of the 2 ^{2}S/sub 1/2/ state. We find the lifetime of the unperturbed 2 ^{2}S/sub 1/2/ state to be 3.487(0.036) ns in agreement with the theoretical value of 3.497 ns. This is the first measurement of the 2 ^{2}S/sub 1/2/ state lifetime of sufficient accuracy to observe the contribution to the total decay rate of the single-photon magnetic dipole decay. Our measured value of the Lamb shift is δE(2 ^{2}S/sub 1/2/-2 ^{2}P/sub 1/2/) = 37.89(0.38) THz, lower than, but in agreement with, Mohr's value of 38.25(0.025) THz, and 2.7 standard deviations below Erickson's value of 39.01(0.16) THz. Both the quenched and natural lifetimes were measured by the beam-foil time-of-flight technique. In this paper we emphasize the treatment of the systematic effects in the beam-foil time-of-flight method including cascades from higher excited states, interference from the spectra of heliumlike ions, collisions in the residual gas, and perturbations from a highly excited extra electron, as well as systematic effects more unique to electric field quenching.

6795 **Pseudopotential local-spin-density calculations for Si_2.** Northrup, J.E.; Yin, M.T.; Cohen, M.L. (Department of Physics, University of California, Berkeley, Berkeley, California 94720 and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review [Section] A: General Physics;* **28**: No. 4, 1945-1950(Oct 1983).

Pseudopotential local-spin-density calculations of the bond lengths, vibrational energies, and dissociation energies for the $^3\Sigma$/sub g/$^-$, ^{3}Pi/sub u/, and two $^1\Sigma$/sub g/$^+$ states of the silicon dimer have been performed. The bond lengths are within 1% and the vibrational frequencies are within 5% of experimental values. The dissociation energy of the ground state is larger than experiment by ~1.25 eV. These results are near the limits of accuracy of the local-spin-density approximation.

6796 **High-current relativistic electron guns.** Paul, A.C.; Neil, V.K. (Lawrence Berkeley Laboratory, University of California, Berkeley, California). *Advances in Electronics and Electron Physics, Supplement;* **13**: No. C1, 141-170(1983).

The operating characteristics of Austron and ETA electron guns are discusssed. Numerical solutions are presented to the relavent theoretical concepts including the effects of self-fields. (AIP)

6797 **Generation of high-power pulsed ion beams.** Kuswa, G.W.; Quintenz, J.P.; Freeman, J.R.; Chang, J. (Sandia National Laboratories, Albuquerque, New Mexico). *Advances in Electronics and Electron Physics, Supplement;* **13**: No. C1, 295-350(1983). Contract AC04-76DP00789.

The principles of operation of pulsed ion diodes are reviewed. The channel propagation of ion beams is also considered in detail. (AIP)

6798 **Inelastic scattering of high energy electrons by crystals.** Bird, D.M. Cambridge, England; Cambridge University (1981). 200p. British Library, Boston Spa, Wetherby, West Yorks. No. D43021/82.

Thesis.

The inelastic scattering of high energy electrons by crystals is discussed, concentrating in particular on the influence of diffraction on various inelastic scattering processes. Single inelastic scattering is considered and it is shown that, as is the case if diffraction is unimportant, the scattering cross section can be related to the dielectric response function of the crystal. However, it is shown that diffraction can play an important role and simple models are developed for various excitation processes. Using these, the changes which occur when diffraction is included are investigated. A theory of multiple inelastic scattering is developed in terms of a transport equation. The scattering is envisaged as a diffusion of electrons over the dispersion surface as they pass through the crystal and the intensity distribution below the crystal is investigated for the case of a crystal which is considerably thicker than an inelastic scattering mean free path. Diffraction is again shown to play an important part.

6799 **Investigation of the electromagnetic properties of atoms and molecules.** Hinds, E.A. Oxford, England; Oxford University (1975). 160p. British Library, Boston Spa, Wetherby, West Yorks. No. D36465/81.

Thesis.

A molecular beam resonance experiment has been carried out using thallium fluoride to search for a violation of parity (P) and time reversal invariance (T) in a molecule. The null result has been interpreted in terms of the electric dipole moment of the proton. A second interpretation has been made in terms of a possible neutral current weak interaction between electrons and nucleons.

6404 Fluid Physics

6800 (DOE/ER/03077—202) Automatic adaptive grid refinement for the Euler equations. Berger, M.J.; Jameson, A. (New York Univ., NY (USA). Courant Mathematics and Computing Lab.). Oct 1983. Contract AC02-76ER03077. 27p. NTIS, PC A03/MF A01. Order Number DE84004988.

We present a method of adaptive grid refinement for the solution of the steady Euler equations for transonic flow. Our algorithm automatically decides where the coarse grid accuracy is insufficient, and creates locally uniform refined grids in these regions. This typically occurs at the leading and trailing edges. The solution is then integrated to steady state using the same integrator (FLO52) in the interior of each grid. We examine the boundary conditions needed on the fine grids, and discuss the importance of treating the fine/coarse grid interface conservatively. Numerical results are presented.

6801 Low-dimensional chaos in a hydrodynamic system. Brandstater, A.; Swift, J.; Swinney, H.L.; Wolf, A.; Farmer, J.D.; Jen, E.; Crutchfield, J.P. (Department of Physics, University of Texas, Austin, Texas 78712). *Physical Review Letters;* **51**: No. 16, 1442-1445(17 Oct 1983).

Evidence is presented for low-dimensional strange attractors in Couette-Taylor flow data. Computations of the largest Lyapunov exponent and metric entropy show that the system displays sensitive dependence on initial conditions. Although the phase space is very high dimensional, analysis of experimental data shows that motion is restricted to an attractor of dimension less than 5 for Reynolds numbers up to 30% above the onset of chaos. The Lyapunov exponent, entropy, and dimension all generally increase with Reynolds number.

6802 Density dependence of the momentum distribution for ^{4}He. Mook, H.A. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Physical Review Letters;* **51**: No. 16, 1454-1456(17 Oct 1983). Contract W-7405-ENG-26.

Neutron-scattering techniques have been used to determine the momentum distribution n(p) for ^{4}He for different temperatures and densities. n(p) is found to be a strong function of density and thus brings into question any direct relationship between the condensate fraction and the pair distribution function g(r,T).

6803 Implicit moment PIC-hybrid simulation of collisional plasmas. Mason, R.J. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Computational Physics;* **51**: No. 3, 484-535(Sep 1983).

A self-consistent scheme was developed to model electron transport in evolving plasmas of arbitrary classial collisionality. The electrons and ions are treated as either ultiple Eulerian fluids or collisional particles-in-cell. Particle suprathermal electrons scatter off ions, and drag against fluid background thermal electrons. The background electros undergo ion friction, thermal coupling, and bremsstrahlung. The components accelerate in electric field obtained by the Implicit Moment Method, which permits $\Delta t >> \omega^{-1}$/ sub p/ and $\Delta x >> \lambda$/sub p/-allowing the treatment of problems 10^2-10^3 times more complex than those accessible with older explicit methods. The fluid description for the background plasma components permits the modeling of transport in systems spanning more than a 10^7-fold change in density, and encompassing contiguous collisional and collisionless regions. Results are presented from application of the scheme to the modeling of CO_2 laser-generated suprathermal electron transport in expanding thin foils, and in multifoil target configurations.

6804 Finite analytic numerical solution axisymmetric Navier-Stokes and energy equations. Chen, C.; Yoon, Y.H. (Division of Energy Engineering and Iowa Institute of Hydraulic Research, The University of Iowa, Iowa City, Iowa 52242). *Journal of Heat Transfer;* **105**: No. 3, 639-686(Aug 1983). Contract AC02-79ER10515.

Convective heat transfer for steady-state laminar flow in axisymmetric coordinates is considered. Numerical solutions for flow pattern and temperature distribution are obtained by the finite analytic numerical method applied to the Navier-Stokes equations expressed in terms of vorticity and stream function, and the energy equation. The finite analytic numerical method differs from other numerical methods in that it utilizes a local analytic solution in an element of the problem to construct the total numerical solution. Finite analytic solutions of vorticity, stream function, temperature, and heat transfer coefficients for flow with Reynolds numbers of 5, 100, 1000, and 2000, and Prandtl numbers of 0.1, 1.0, and 10.0 with uniform grid sizes, are reported for an axisymmetric pipe with a sudden expansion and contraction. The wall temperature is considered to be isothermal and differs from the inlet temperature. It is shown that the finite analytic is stable converges rapidly, and simulates the convection of fluid flow accurately, since the local analytic solution is capable of simulating automatically the influence of skewed convection through the element boundary on the interior nodal values, thereby minimizing the false numerical diffusion.

6805 Statistical mechanics of a bounded, ideal magnetofluid. Turner, L. (Los Alamos National Laboratory, University of California, Los Alamos, New Mexico 87545). *Annals of Physics (New York);* **149**: No. 1, 58-161(Aug 1983).

A statistical model of a three-dimensional, incompressible, cylindrically bounded, current-bearing magnetofluid is presented for the purpose of gaining insight into the nonlinear relaxation process routinely observed in reversed-field-pinch experiments. An absolute equilibrium ensemble is utilized that incorporates energy, magnetic helicity, and magnetic flux constraints. Results are extracted only after an extensive mathematical treatment of the properties of poloidal and toroidal fields. The model predicts the presence of magnetic fluctuations about a cylindrically symmetric, Bessel-function-model, mean magnetic field, which satisfies del x $<B> = \mu <B>$. As Taylor's Θ-parameter approaches 1.56, the model predicts tha the significant region of the fluctuation spectrum narrows down to a single (coherent) m = 1 mode. An analogy between the Debye length of an electrostatic plasma and μ^{-1} suggests the physical validity of the model's prediction of the magnetic-field-fluctuation autocorrelation tensor $<\delta B(r)\ \delta B(r')>$, when ' r-r' '> or $=\mu^{-1}$.

6450 High Energy Physics

6806 (INIS-mf—8672) 1983 Annual convention of the Austrian Physical Society, University of Linz, 28 - 30 September 1983. (Oesterreichische Physikalische Gesellschaft, Vienna). 1983. 119p. (In German). (CONF-8309179—Absts.). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84700519.

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

Proceedings of lectures and poster presentations given at the 1983 convention of the Austrian Physical Society, with (German) abstracts only. The four topical sessions were: 1) electrodynamics and optics 2) solid state physics 3) nuclear and particle physics 4) physics of high polymers Only part of the presentations pertain to the subject scope of INIS.

6807 (LBL—16140) Physics, computer science and mathematics division. Annual report, 1 January - 31 December 1982. Jackson, J.D. (Lawrence Berkeley Lab., CA (USA)). Aug 1983. Contract AC03-76SF00098. 83p. NTIS, PC A05/MF A01. Order Number DE84003915.

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Experimental physics research activities are described under the following headings: research on e^+e^- annihilation; research at Fermilab; search for effects of a right-handed gauge boson; the particle data center; high energy astrophysics and interdisciplinary experiments; detector and other research and development; publications and reports of other research; computation and communication; and engineering, evaluation, and support operations. Theoretical particle physics research and heavy ion fusion research are described. Also, activities of the Computer Science and Mathematics Department are summarized. Publications are listed. (WHK)

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 6470, 6548, 6559, 6878, 6927

6808 **(BNL—33864) Low energy neutrino physics.** White, D.H. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 18p. (CONF-830798—6). NTIS, PC A02/MF A01. Order Number DE84002856.

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

Two reactions (anti nu)/sub μ/e → (anti nu)/sub μ/)e and (anti nu)/sub μ/p → (anti nu)/sub μ/p are perceived to be of fundamental importance in the understanding of the low energy behavior of the neutral current process. The limit to the accuracy of determination of these low energy parameters is due to statistics in the first case and systematic effects in the second. Increases in neutrino flux can be expected in the future both at the AGS in the near future and ultimately at accelerators like LAMPF II. These increases can be used to increase the available counts and also to take advantage of increased segmentation of the detectors to improve systematic understanding of the data. The need to match progress on both statistical and systematic fronts is hard to exaggerate, and will require a program of continuous improvement in detector and accelerator quality.

6809 **(DOE/ER/03956—2) Bubble chamber studies of hadron and photon interactions. Progress report, April 1, 1983-March 31, 1984.** Bugg, W.M.; Brau, J.E.; Condo, G.T.; Handler, T.; Hart, E.L. (Tennessee Univ., Knoxville (USA)). 1983. Contract AS05-76ER03956. 12p. NTIS, PC A02/MF A01. Order Number DE84003445.

Progress is briefly reported on a number of experiments on hadron and photon interactions. Stand-alone bubble chamber experiments were completed, and current efforts focus on hybrid chamber research. Two new projects are being proposed-mu neutrinos in the Kitigaki bubble chamber at Fermilab, and a search for a threshold enhancement in the production of sigma particles in the SLAC 40 hybrid chamber. Photoproduction and antinucleon physics are covered. Experiments at CERN were run to observe diffractive strange particle production. (LEW)

6810 **(DOE/ER/14529—T1) Phi meson and accompanying strange particle production in 16 GeV/c πi p interactions. Final report.** Hylen, J.E. (Michigan State Univ., East Lansing (USA). Dept. of Physics). 1982. Contract AC02-77ER14529. 155p. NTIS, PC A08/MF A01. Order Number DE84002769.

Portions are illegible in microfiche products; Thesis.

We have studied phi production in 16 GeV/c π^+p interactions. K^- identified in a Cherenkov counter were used to trigger the Stanford Linear Accelerator Center 2-meter streamer chamber. A sample of inclusive phi events was thus obtained where phi → K^-K^+. Information from a second Cherenkov counter was used to identify the K^+ off-line. In addition, the visible decays in the streamer chamber of $\Lambda^0 \rightarrow p\pi^-$ and K/sub s/$^0 \rightarrow \pi^+\pi^-$ were used to obtain events of the type $\pi^+p \rightarrow$ phi Λ^0 + anything and $\pi^+p \rightarrow$ phi K/sub s/^{0} + anything. With 1.26 x 10^8 π^+ onto a 61 cm liquid hydrogen target, the experiment had a raw sensitivity of 3.1 events/nb. For the film measured so far, taking into account geometric acceptance, unseen decay modes, and all efficiency corrections, the sensitivities are 7.1 events/μb, 22 events/μb, and 27 events/μb respectively for the phi inclusive, phi with Λ^0, and phi with K/sub x/^{0} samples. The acceptance covers the region in Feynman's x, x/sub phi/ > 0.5. The measured cross sections for x/sub phi > 0.5 are sigma(phi + chi) = 1.3 +- 2.0 μb, sigma(phi Λ^0 + chi) = 0.37 +- 0.16 μb, and sigma(phi K/sub s/^{0} + chi) = 0.33 +- 0.15 μb. When account is taken of unseen associated channels, it is concluded that phi is predominantly produced conjointly with pairs of strange particles. This agrees with the OZI rule, and is consistent with phi being produced by a quark fusion type process, rather than gluon fusion or light quark annihilation. 43 references.

6811 (DOE/ER/40058—1, pp 289-319) **Highlights in e^+e^- physics.** Mistry, N.B. (Cornell Univ., Ithaca, NY). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

Results from e^+e^- colliding beam experiments mainly in the energy range from 3 GeV to 11 GeV are reviewed. Results include tests of quantum electrodynamics, detection of the Tau lepton, hadron production, spectroscopy of heavy bound quarks, decay of bound states and production and decay of new heavy mesons. (KAW)

6812 (DOE/ER/40058—1, pp 424-426) **Measurement of elastic electron-neutron cross section up to $Q^2 = 10$ GeV/c^2.** Rock, S.; Arnold, R.G.; Bosted, P.; Chertok, B.T.; Mecking, B.A.; Schmidt, I.; Szalata, Z.M.; York, R.C.; Zdarko, R. (American Univ., Washington, DC). 1983. NTIS, PC A99/MF A01. (CONF-820475—). Contract AC03-76SF00515.

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

The internal electromagnetic structure of the nucleons has been an exciting field of experimental and theoretical research. With the advent of QCD, explicit predictions for the large Q^2 behavior of elastic nucleon form factors have now been made. In order to extend the range in four-momentum transfer of a fundamental property of the nucleon, we have measured the elastic electron-neutron cross section up to $Q^2 = 10$ (GeV/c)^2. The experiment was performed at End Station A at SLAC by detecting electrons scattered from deuterium and by hydrogen targets. The incident beam energy was varied from 9.8 to 21 GeV in five steps. The 20 GeV spectrometer detected electrons at 10^0, with momentum settings that covered the entire quasi-elastic peak and well into the inelastic region. The elastic proton cross sections were measured absolutely and were found to be in excellent agreement with previous data.

6813 (DOE/ER/40058—1, pp 601-603) **Y scaling in d, ^{3}He, and ^{4}He.** Bosted, P.; Arnold, R.G.; Rock, S.; Szalata, Z. (American Univ., Washington, DC). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

In recent years it has been recognized that the cross section for quasi-elastic electron scattering from nuclei can be represented by a universal function F(y). In the impulse approximation, the scaling variable y is related to the fermi momentum of the struck nucleon. The scaling prediction has been verified for absolute value y absolute value < 0.3 GeV/c for nuclei such as calcium and carbon, and for a much larger range of y using ^{3}He data. In this report we present new data for deuterium which exhibit remarkable y scaling, and compare the results to those from ^{3}He and ^{4}He.

6814 (DOE/ER/40058—1, pp 604-606) **Proposal to measure the electromagnetic properties of the Δ(1236) isobar.** Orphanos, L.; Altemus, R. (Univ. of Virginia, Charlottesville). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

We propose to measure the reaction ^{4}He(e,e'pπ^+)^{3}H at NEAL where the kinematics of p,π^+ at an invariant mass (1236)^2 + q^2 would ensure that we have scattered from a Δ^{++}. Scattering at 180^0 is purely magnetic, and the fact that electrons allow independent variaton of q and ω will allow us to measure the momentum-dependence of the Δ magnetic form-factor. The double coincidence measurements and the fact that Δ's are pre-existent in ^{4}He only ~ 4% of the time necessitate the high duty-factor expected to be available at NEAL.

6815 (DOE/ER/40058—1, pp 607-609) **Proposal to measure ^{6}Li(e,e'pp)X.** Orphanos, L.; Altemus, R.; Norum, B. (Univ. of Virginia, Charlottesville). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

We propose to study the reaction ^{6}Li(e,e'pp)X at NEAL, with the objective of mapping out form-factors. ^{6}Li is a particularly favorable nucleus for such a study: (1) It is a system whose shell-model structure is well-known, and simple (ls-lp shells only). (2) One can hope to model ^{6}Li = ^{4}He core + ^{2}H in orbit; ^{4}He is favorable for short-range studies because of its high central density, but the solid Li precludes the technical problems of a gas or liquid He target. (3) The low Fermi momentum, k/sub F/ = 169 MeV/c, yields easy access to the energy-loss regions where the single-particle cross-section is zero and any finite cross-section can be attributed in part to correlations.

6816 **(FERMILAB-CONF—83/76-EXP) Measurement of sin^2*L*/sub w/ in semileptonic nu Fe and anti nu Fe interactions.** Blair, R.E.; Bodek, A.; Coleman, R.N.; Edwards, D.; Edwards, H.T.; Fackler, O.D.; Fisk, H.E.; Fukushima, Y.; Jenkins, K.A.; Jin, B.N. (California Inst. of Tech., Pasadena (USA); Chicago Univ., IL (USA); Columbia Univ., New York (USA); Fermi National Accelerator Lab., Batavia, IL (USA); Rochester Univ., NY (USA); Rockefeller Univ., New York (USA)). Oct 1983. Contract AC02-76CH03000. 13p. (CONF-830231—7). NTIS, PC A02/MF A01. Order Number DE84003186.

From Europhysics study conference on electroweak effects at high energies; Erice, Italy (1 Feb 1983).

Results from neutral current scattering of muon neutrinos and antineutrinos on iron nuclei by the CCFRR experiment at Fermilab are reported. Our objective is the measurement of sin$^2\theta$/sub w/ from inclusive semileptonic neutrino-nucleon interactions. Such a measurement, even through it is subject to more corrections than the analogous measurement in neutrino-electron scattering (e.g. due to the presence of a strange quark sea in the nucleon), has a high degree of statistical accuracy and may afford the most precise test of the standard model of electro-weak interactions. Furthermore, the recent observations of the Z^0 and W^{-+} in proton-antiproton collisions give such a measurement added topical interest. The comparison of sin$^2\theta$/sub w/ determined from the masses of the Z^0 and W^{-+} and from neutrino interactions, i.e. from different processes and energy regions, may hold some surprises. Finally, the grand-unified theories make definite predictions about the value of sin$^2\Theta$/sub w/ and the lifetime of the proton; sin$^2\theta$/sub w/ measurements test the validity of these theories. The experiment was performed in Fermilab's dichromatic neutrino beam and utilized a large detector consisting of an iron-scintillator target calorimeter followed by a steel toroidal muon spectrometer.

6817 **(INIS-mf—8231) DESY annual report of scientific activities 1981.** (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). 1981. 201p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE83703924.

This annual report contains short descriptions of the experiments at the storage rings PETRA and DORIS together with the experiments with the European Muon-collaboration, the experiments with the sychrotron radiation, the studies of theoretical physics, the developments of detectors and counting electronics, and the development of data processing in medicine, descriptions of the current status of the storage rings PETRA and DORIS and the synchrotron together with the radiation protection and the planning of the HERA storage ring, descriptions of the data processing systems and new developments in cryogenics, as well a list of publications and speeches. (HSI).

6818 (INIS-mf—8672, pp 99) **Results of the UA1 experiment at the CERN proton-antiproton collider.** Dallmann, D. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6819 (INIS-mf—8672, pp 106) **Correlation measurements in lepton-lepton, lepton-hadron and hadron-hadron interaction.** Buschbeck, B. 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6820 (INIS-mf—8672, pp 107) **Results of the experiment NA16 - search for charm.** Rohringer, H. 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6821 (INIS-SU—196, pp 74-76) **Radiation pion photoproduction on hydrogen.** Ajbergenov, T.A.; Baranov, P.S.; Osadchij, A.I. (AN SSSR, Moscow. Fizicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8105209—No.1(19)).

From All-union seminar electromagnetic interactions of hadrons in the resonance energy range; Khar'kov, Ukrainian SSR (26 May 1981).

Cross section for radiation charged pion photoproduction on hydrogen ($\gamma p \rightarrow \gamma\pi^+ n$) is measured. All the three particles: scattered photon, pion and neutron have been detected in the reaction final state. A time-transit on line measuring system with the D-116 computer has been used in the experiments. Geometry of the experiment has been chosen proceeding from the condition of kinematic separation from the background process $\gamma p \rightarrow \pi^+\pi^0 n \rightarrow \pi^+\gamma\gamma\pi^0$ by neutron detection at a limiting escape angle. The installation efficiency has been calculated using the mathematical simulation program in the ES1040 computer. 10^{-32} cm^2/μm^4 cross section is obtained in the result of processing the preliminary series of the experiments.

6822 (INIS-SU—196, pp 17-18) **Pion photoproduction and scattering by nucleons: T invariance and the Δ_{33} isomultiplet characteristics.** Sanin, V.M.; Sorokin, P.V.; Shalatskij, S.V.; Miroshnichenko, I.I. 1982. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8105209—No.1(19)).

From All-union seminar electromagnetic interactions of hadrons in the resonance energy range; Khar'kov, Ukrainian SSR (26 May 1981).

Multipole analysis of the $\gamma p \rightarrow N\pi$ reaction is conducted using the regularization method, in which the values of the Msub(1+)sup((3)) amplitude phase and module are specified. A new evaluation of T-invariance correctness boundary of hadron electromagnetic interactions is obtained on the base of the determined magnitudes. Characteristics of the Δ_{33}-isomultiplet: pole characteristics of the Δ_{33}^+-isobar (pole coordinates and subtraction relatively to the Msub(1+)sup((33)) amplitude pole) and evaluations of the Δ_{33}-isomultiplet mass splitting are obtained.

6823 **(LA-UR—83-3359) Status of μ decays.** Kinnison, W.W. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 24p. (CONF-8309163—3). NTIS, PC A02/MF A01. Order Number DE84003831.

From Conference on low energy tests of conservation laws in particle physics; Blacksburg, VA, USA (12 Sep 1983).

A short theoretical review of the weak interaction is presented with particular emphasis on the implications to normal and rare muon decay processes. This review addresses the standard theory, left-right symmetry theories, theories with horizontal symmetries, and composite models. A survey of experiments currently in progress to study both rare and normal muon decays is then presented with particular emphasis on the Los Alamos high statistics muon decay experiment and its implications for left-right symmetric theories. 16 references.

6824 **Study of the p-barp→n-barn reaction in the momentum range 480 to 728 MeV/c.** Tsuboyama, T.; Kubota, Y.; Sai, F.; Sakamoto, S.; Yamamoto, S.S. (Department of Physics, University of Tokyo, Bunkyo-ku, Tokyo 113, Japan). *Physical Review* [*Section*] *D: Particles and Fields;* **28**: No. 9, 2135-2140(1 Nov 1983).

The total and differential p-barp charge-exchange cross sections were obtained at seven momenta in the range 480 to 728 MeV/c. The total cross sections are roughly consistent with other data. The momentum dependences of the Legendre coefficients a_l/

a_0, a_2/a_0, and a_3/a_0 of the differential cross sections do not agree well with the predictions of the Bryan-Phillips model, unlike the case of elastic scattering.

6825 **Possible evidence for magnetic-monopole interactions: Anomalous long-range α-particle tracks deep underground.** Anderson, S.N.; Lord, J.J.; Strausz, S.C.; Wilkes, R.J. (Visual Techniques Laboratory, Department of Physics FM-15, University of Washington, Seattle, Washington 98195). *Physical Review* [*Section*] *D: Particles and Fields;* **28**: No. 9, 2308-2310(1 Nov 1983).

We remark that previously reported anomalous long-range α-particle tracks observed deep underground may provide evidence for ternary nuclear fission induced by grand-unification-theory monopoles.

6826 **Measurement of the cross section of ν/sub μ/ $+e^- \rightarrow \nu$/sub μ/ $+e^-$.** Ahrens, L.A.; Aronson, S.H.; Connolly, P.L.; Erickson, T.E.; Gibbard, B.G.; Montag, M.; Murtagh, M.J.; Murtagh, S.J.; Terada, S.; Thorndike, A.M. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review Letters;* **51**: No. 17, 1514-1517(24 Oct 1983).

The result of a measurement of $\sigma(\nu$/sub μ/$+e^- \rightarrow \nu$/sub μ/ $+e^-)$ is presented. With use of neutrinos of mean energy 1.5 GeV from the Brookhaven National Laboratory alternating gradient synchrotron and a massive, active, high-resolution detector, a signal of 51 +- 9 events with a average signal-to-background ratio greater than 2:1 is observed. $\sigma(\nu$/sub $\mu/e^- \rightarrow \nu$/sub $\mu/+e^-)$ = [1.60 +- 0.29(stat) +- 0.26(sys)] E/sub ν/ (GeV) x 10^{-42} cm^2 is obtained.

6827 **Measurement of spin parameters for a decisive clarification of the structure observed in the p-p system.** Auer, I.P.; Colton, E.; Ditzler, W.R.; Hill, D.; Miller, R.; Spinka, H.; Theodosiou, G.; Tavernier, J.; Tamura, N.; Toshioka, K. (Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review Letters;* **51**: No. 16, 1411-1414(17 Oct 1983).

Recent data are presented on spin-spin correlation parameters C/sub L/L = (L,L;0,0) and C/sub S/L = (S,L;0,0) at forward angles from 1.18 to 2.47 GeV/c incident momenta in proton-proton elastic scattering. Values for $\Delta\sigma$/sub L/ (inelastic) are derived and are shown to disagree with predictions of theoretical models attempting to describe p-p scattering without dibaryon resonances. Finally, the C/sub L/L and C/sub S/L data discriminate among various phase-shift solutions, and will lead to a clarification of the p-p phase shifts.

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 6558, 6813, 6823, 6823, 6864, 6868, 6870, 6920, 6921

6828 **(DESY-L-Trans—275) e^+e^--annihilation into hadrons near narrow vector resonances.** Pankov, A.A.; Satsunkevich, I.S. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Apr 1983. 17p. Deutsches Elektronen-Synchron (DESY), Hamburg (Germany, F.R.).

Interference effects of electroweak interactions in e^+e^- -> hadron annihilation near narrow vector states of quarkonium systems will be discussed. Near-resonance effects, which had been previously investigated for eanti e -> μanti μ, eanti e-processes, have also be located theoretically in the case of eanti e -> hadron processes. It has been proved that the corresponding near-resonance quantities are of the same order as in the eanti e -> μanti M process. However, general hadron-annihilation predictions depend on quark-into-hadron fragmentation fuctions. The simplest experimentally testable effects will be presented, which provide with interesting physical information on fragmentation functions or on parameters of weak neutral current of new quarks. The importance of direct hadronic decay channels of vector mesons for the estimation of the singularity widths of interference effects will be studied using the tau-resonance as an example.

6829 **(DESY-L-Trans—278) Polarization effects in $\gamma + \gamma$ -> $W^+ + W^-$.** Inopin, A.E.; Rekalo, M.P. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). May 1983. 14p. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.).

Translated from Russian. Preprint KFTI--82-49.

Taking account of the symmetry properties of the matrix element of the $\gamma + \gamma$ -> $W^+ + W^-$ process with respect to photon permutation, the authors found simple expressions for structure functions defining the dependence of the differential cross-section of $\gamma + \gamma$ -> $W^+ + W^-$ on the polarized characteristics of one of the photons as well as expressions for density matrix elements of the W^--boson (the other particles in $\gamma + \gamma$ -> $W^+ + W^-$ are non-polarized). All calculations have been carried out for an arbitrary anomalous magnetic model of the W-boson K. As predicted by the Weinberg-Salam model, for specific relations between the density matrix elements of the W^--boson arise for K = 1. It is proved that the asymmetry of angular distribution of W-bosons dependent on linear photon polarization as well as the density matrix elements of W-bosons are sensitive to the value of K.

6830 **(DOE/ER/40058—1) New horizons in electromagnetic physics.** Noble, J.V.; Whitney, R.R. (eds.). (Virginia Univ., Charlottesville (USA). Dept. of Physics). 1983. Contract FG05-82ER40058. 629p. (CONF-820475—). NTIS, PC A99/MF A01. Order Number DE84002600.

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

Portions are illegible in microfiche products.

Separate abstracts were prepared for papers from the conference on New Horizons in Electromagnetic Physics held at the University of Virginia, April 21 to 24, 1982. (KAW)

6831 (DOE/ER/40058—1, pp 61-76) **Anomalies in electromagnetic nuclear physics.** Tamas, G. (CEN Saclay, Gif-sur-Yvette, France). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

We present and discuss some unexplained facts in light nuclei knock out reactions, in the comparison of real and virtual photon induced reactions, in ^{3}He quasi elastic electron scattering and in D(γ,pπ) reaction.

6832 (DOE/ER/40058—1, pp 397-417) **Beyond the impulse approximation.** Noble, J.V. (Univ. of Virginia, Charlottesville). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

The validity of the impulse approximation in electromagnetic physics is discussed, with reference to quantum field theoretic treatments of nuclear structure. It is found that the currently accepted versions of these theories (a) fit the properties of isolated baryons reasonably well; and (b) require substantial renormalization of these properties in nuclei.

6833 (DOE/ER/40058—1, pp 537-541) **Quark structure of nucleons: the third bag.** Wilets, L. (Univ. of Washington, Seattle). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

The soliton bag model proposed by Friedberg and Lee is discussed. Unlike the other bag models, it treats the confining bag as a fully dynamical object. A scalar soliton field is introduced to effect confinement. The combined quark-soliton system (plus gluons, Higgs fields, counter terms) is described by a Hamiltonian or Lagrangian. The standard bag models do not have a complete Hamiltonian or Lagrangian. The resulting bag can undergo oscillations, rotations and dynamical distortions.

6834 (DOE/ER/40058—1, pp 551-553) **Polarized electron deep inelastic scattering on ^{3}He.** Woloshyn, R.M. (TRIUMF, Vancouver, British Columbia). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

A parton model, incorporating QCD predicted quark polarization, is constructed for electron scattering on ^{3}He and results for the asymmetry are compared with a spin-independent convolution model.

6835 (DOE/ER/40058—1, pp 554-565) **What can we learn from electrons, positrons, and photons in the energy range 2 to 4 GeV.** Durand, B. (Univ. of Wisconsin, Madison). 1983. NTIS, PC A99/MF A01. (CONF-820475—). Contract AC02-76ER00881.

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

This paper focuses on the energy range 2 to 4 GeV and on five processes: e^-N, e^-e^-, e^+e^-, γN, and $\gamma\gamma$. some new applications and some older unsettled questions in nuclear, particle, and solid state and atomic physics constitute the new ideas of the paper. In particle physics, a detailed study of mesons up through the charm states and of structure functions and form factors, better determination of the strong coupling constant, and insight into relativistic bound states would be benefits of a 4 GeV e^- accelerator with a storage ring.

6836 (DOE/ER/40058—1, pp 566-568) **Electromagnetic current in weak interactions.** Ma, E. (Univ. of Hawaii at Manoa, Honolulu). 1983. NTIS, PC A99/MF A01. (CONF-820475—). Contract AM03-76SF00235.

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

In gauge models which unify weak and electromagnetic interactions, the weak neutral-current interaction also involves the electromagnetic current. The exact nature of such a component can be explored using e^+e^- experimental data. In recent years, the existence of a new component of the weak interaction has become firmly established, i.e., the neutral-current interaction. As such, it competes with the electromagnetic interaction whenever the particles involved are also charged, but at a very much lower rate because its effective strength is so small. Hence neutrino processes are best for the detection of the neutral-current interaction. However, in any gauge model which unifies weak and electromagnetic interactions, the weak neutral-current interaction also involves the electromagnetic current.

6837 **(INIS-mf—8249) Search for resonances in the antiproton-proton system at low energies.** Walczak, R. (Heidelberg Univ. (Germany, F.R.). Naturwissenschaftlich-Mathematische Gesamtfakultaet). 1981. 91p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE83704611.

Thesis.

The excitation function of the annihilation and elastic cross-sections for the antiproton-proton scattering have been measured in the mass range from 1910 to 1978 MeV. The experiment was characterized by a mass resolution of about 0.4 MeV (R.M.S.) and a statistical significance of 1.2% (R.M.S.) for the annihilation channel. With this precision a narrow structure at a mass of 1936 MeV was observed. This structure is not of a simple Breit-Wigner shape. However, it might be identified with the S-meson reported by a previous experiment.

6838 (INIS-mf—8672, pp 101) **Coulomb-nuclear interference in hadronic atoms.** Thaler, J. (Graz Univ. (Austria). Inst. fuer Theoretische Physik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6839 (INIS-mf—8672, pp 20) **Pions and muons as a tool in nuclear and particle physics.** Engfer, R. (Zurich Univ. (Switzerland)). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6840 (INIS-mf—8672, pp 102) **Proton decay in unified theories.** Lucha, W. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6841 (INIS-mf—8672, pp 106) **Higgs particles within the framework of a lattice QCD.** Lang, C.B.; Vones, G. (Graz Univ. (Austria)); Kuehnelt, H. (Vienna Univ. (Austria)). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6842 (INIS-mf—8672, pp 106) **Proton fragmentation in K^- p-interactions at 110 GeV/c.** Girtler, P.; Kuhn, D. (Innsbruck Univ. (Austria). Inst. fuer Experimentalphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6843 (INIS-mf—8672, pp 107) **Hadron fragmentation of quarks.** Gerhold, H.R. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6844 (INIS-mf—8672, pp 108) **Diffractive production of a heavy quark-antiquark pair from protons.** Mandl, F.; Markytan, M. 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6845 **(INIS-SU—180) Quarks-80. Proceedings of seminar.** (AN SSSR, Moscow; AN Ehstonskoj SSR, Tartu. Inst. Astrofiziki i Fiziki Atmosfery; AN SSSR, Moscow. Inst. Yadernykh Issledovanij; Tbilisskij Gosudarstvennyj Univ. (USSR)). 1981. 158p. (In Russian). (CONF-8004233—). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84780038.

From Seminar Quarks-80; Sukhumi, USSR (22 Apr 1980).

Individual items in scope for the data base are processed separately.

6846 (INIS-SU—196, pp 92) **Pion back electroproduction in resonance model.** Mosolov, V.A.; Smirnov, G.I.; Shume ko, N.M. (Belorusskij Gosudarstvennyj Univ., Minsk). 1982. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8105209—No.1(19)).

From All-union seminar electromagnetic interactions of hadrons in the resonance energy range; Khar'kov, Ukrainian SSR (26 May 1981).

Calculation of differential and total cross sections of the pion back electroproduction is exercised within the frames of the resonance model. N(1520) and N(1535)-resonance contributions are taken into account besides the Born terms and Δ(1232)-resonance contribution. The main contribution is made by the Born terms and the resonance contribution into the total cross section does not exceed 30%, up to 24% of the contribution being made by the Δ (1232)-resonance.

6847 (INIS-SU—196, pp 83-86) **Quark nature of weak effects in electromagnetic transitions and nuclear reactions.** Dubovik, V.M.; Zenkin, S.V.; Obukhovskij, I.T.; Tosunyan, L.A. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8105209—No.1(19)).

From All-union seminar electromagnetic interactions of hadrons in the resonance energy range; Khar'kov, Ukrainian SSR (26 May 1981).

Physics of weak nucleon-nucleon interactions in the two approaches: general potential and quark-nuclear is considered on the base of a standard model of weak interactions and quantum chromodynamics. Importance of precise measurements of parity breaking effects due to the possibility of obtaining data on fundamental shart-range interactions of quarks is underlined.

6848 (INIS-SU—196, pp 41-42) **Possible manifestation of the second-class currents in the tau lepton decay on the vector mesons.** Barannik, V.P.; Korzh, A.P.; Rekalo, M.P. 1982. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8105209—No.1(19)).

From All-union seminar electromagnetic interactions of hadrons in the resonance energy range; Khar'kov, Ukrainian SSR (26 May 1981).

tau → νrhoπ decay is studied in supposition of the presence of second-class currents in a weak hadron current. Contribution of these currents to energy distributions of the formed hadrons as well as the decay width is calculated. An evaluation of the constant determining the second-class current contribution is made.

6849 (INIS-SU—196, pp 31-33) **Weak neutral currents in the deuteron electrodisintegration.** Gakh, G.I.; Rekalo, M.P. 1982. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8105209—No.1(19)).

From All-union seminar electromagnetic interactions of hadrons in the resonance energy range; Khar'kov, Ukrainian SSR (26 May 1981).

Contribution of neutral weak current into the $e^- d \rightarrow e^- pn$ deutron disintegration is calculated. The case when the deutron target has vector polarization is considered. The calculations are conducted within the frames of impulse approximation with account of relativistic corrections and using the formalism of density matrix of virtual nucleon.

6850 (INIS-SU—196, pp 90-91) **Electromagnetic corrections to inelastic scattering of polarized electrons on polarized nucleons.** Kukhto, T.V.; Shumejko, N.M. (Belorusskij Gosudarstvennyj Univ., Minsk). 1982. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8105209—No.1(19)).

From All-union seminar electromagnetic interactions of hadrons in the resonance energy range; Khar'kov, Ukrainian SSR (26 May 1981).

Electromagnetic radiation corrections for inelastic scattering of polarized electrons on polarized nucleons are investigated. Precise formulae are suggested for low-order corrections for the lepton current. Calculations for from 1 to 16 GeV electrons are carried out, the precise calculations are compared with the calculations conducted by different variants of approximated formulae. The corrections in the Born asymmetry in a large part of the kinematic region are not shown to exceed 10% and only in some kinematic limits they can approach several dozen percent.

6851 **Ground-state and P-wave b-flavored baryons in a consistent quark model with hyperfine interactions.** Kalman, C.S.; Pfeffer, D. (Concordia University, Elementary Particle Physics Group, 1455 de Maisonneuve Boulevard West, Montreal, Quebec H3G 1M8, Canada). *Physical Review* [*Section*] *D: Particles and Fields;* **28**: No. 9, 2324-2325(1 Nov 1983).

Masses of the various ground-state and P-wave baryons containing one b quark and u and d quarks are calculated using a parameter set developed for the noncharmed baryons. The sole additional parameter needed, m/sub b/, is obtained from a previous fit to phi, psi, and Y systems using the same parameter set.

6852 **Higgs-scalar masses and neutron oscillations in SO(10).** Sokorac, A. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973 and Laboratory for Theoretical Physics, "Boris Kidric" Institute, P.O. Box 522, 11001 Beograd, Yugoslavia). *Physical Review* [*Section*] *D: Particles and Fields;* **28**: No. 9, 2329-2332(1 Nov 1983).

By relaxing the survival principle for their masses, we study the Higgs-scalar effects on the mass scales in the SO(10) theory with the constraint of possibly observable n-n-bar oscillations. All possible combinations of Higgs scalars from 10, 120, and 126 representations which are allowed to be light (without endangering the proton-decay limits) are considered. Under the assumption that all Higgs scalars which we choose to be light have equal masses we find that there are solutions (i.e., combinations of light Higgs scalars) which give observable n-n-bar oscillations in the allowed range of the low-energy parameters of the theory and for M/sub R/$\cong$200—10^5 GeV. Furthermore, there emerges a possibility of low M/sub R/$\cong$3M/sub W/ solutions of Rizzo and Senjanovic with $\sin^2\theta$/sub W/, however, as low as 0.246. In all cases the unification mass scale M/sub X/$\cong$(1—4) x 10^{14} GeV, which predicts tau/sub p/$\cong 10^{28}$—10^{31} yr, similarly to the minimal SU(5) theory.

6853 **Possible evidence of Q^2Q^2 mesons in $\gamma\gamma \rightarrow rho^0 rho^0$ and $rho^+ rho^-$ reactions.** Li, B.; Liu, K. (Department of Physics and Astronomy, University of Kentucky, Lexington, Kentucky 40506). *Physical Review Letters;* **51**: No. 17, 1510-1513(24 Oct 1983). Contract AS05-82ER40074.

Recent $\gamma\gamma \rightarrow rho^+ rho^-$ data in the 1.3—2.0-GeV region show a strong suppression as compared to $\gamma\gamma \rightarrow rho^0 rho^0$ data in the same region which suggests an interference between an isoscalar and an exotic isotensor structure. Both the $rho^0 rho^0$ and the $rho^+ rho^-$ data can be accounted for quantitatively in terms of the unique flavor and color-spin structures of the I = 0 and I = 2 Q^2Q^2 states. The possible connection to $rho^0 rho^0$ structure in J/psi radiative decay is suggested. Other 2^{++} Q^2Q^2 candidates in hadronic collisions are briefly discussed.

6854 **Nuclear proton decay.** Cahill, K. (Department of Physics and Astronomy, University of New Mexico, Albuquerque, New Mexico 87131). *Physical Review Letters;* **51**: No. 17, 1600-1600(24 Oct 1983). Contract AC04-81ER40042;AC03-76SF00515.

The effect of nuclear collisions on the decay rate of a proton inside a nucleus is discussed.

6855 **Baryon number in chiral bag models.** Goldstone, J.; Jaffe, R.L. (Center for Theoretical Physics, Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physical Review Letters;* **51**: No. 17, 1518-1521(24 Oct 1983). Contract AC02-76ER03069.

When a massless, isospinor Dirac field is confined to a finite region of space by means of a chiral boundary condition parametrized by an angle θ, the baryon number of the vacuum is shown to be (chi/2π)(θ-sinθ cosθ) where chi is the Euler characteristic of the bounding surface. Some implications for chiral bag models are discussed.

6856 **Regge models of hadronic elastic scattering at all angles.** Kearney, P.J. Durham, England; Durham University (1982). 232p. British Library, Boston Spa, Wetherby, West Yorks. No. D44258/83.

Thesis.

A Regge-based model for the elastic scattering of hadrons at all angles is developed, which combines the best features of a conventional Regge model with those of a quark interchange model. As t tends to -infinity the meson Regge trajectories approach negative integers, while their residues vary like negative integer powers of t, the sum of the two integers being such that the Dimensional Counting Rule is satisfied. Within this framework nucleon-nucleon differential cross sections, polarizations and spin correlation parameters, and π^{+-}p differential cross-sections are studied. It is found that the Regge pole terms dominate for -t <= 1 $(GeV/c)^2$, Regge cuts become important at intermediate t values, but at large angles the meson-Reggeons (with trajectories now approaching integers) re-emerge as the most important contributions. Fits are presented which give a good account of the experimental data at all angles for the pp, pn and pp differential cross-sections, polarizations and spin correlation parameters (where available) and the π^{+-}p differential cross-sections.

6857 **Production and lifetime of charmed particles.** Cartwright, P. Oxford, England; Oxford University (1980). 298p. British Library, Boston Spa, Wetherby, West Yorks. No. D37292/81.

Thesis.

Experimental results on the lifetime of charmed particles and on the hadronic production cross-section for charm in 340 GeV/c π^-p interactions are presented and discussed. A brief review of experimental results on charm lifetime and hadronic production cross-section is presented.

6858 **Phenomenological extensions of the quark parton model.** Burrows, C.J. Cambridge, England; Cambridge University ([nd]). 142p. British Library, Boston Spa, Wetherby, West Yorks. No. D41987/82.

Thesis.

In this thesis a simple phenomenological model for quark-jet fragmentation is constructed, two particle cross sections in opposite side jets in inclusive p - p collisions are calculated and a new model for p - p elastic scattering at large t is discussed.

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 6866

6859 (INIS-mf—8156, pp 190-201) **Lepton number conserved.** Kobzarev, I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. NTIS (US Sales Only), PC A19/MF A01. (CONF-820675—Vol.1).

From International conference on neutrino physics; Balaton, Hungary (14 Jun 1982).

The phenomenological framework for the description of L-violating processes is described, existing possibilities to observe L-violation are compared.

6860 (INIS-SU—180, pp 58-80) **Integral-charge quarks and spontaneously broken color symmetry.** Tavkhelidze, A.N. 1981. (In Russian). NTIS (US Sales Only), PC A08/MF A01. (CONF-8004233—).

From Seminar Quarks-80; Sukhumi, USSR (22 Apr 1980).

A unified model of strong and electromagnetic interactions with broken color symmetry and integral-charge quarks is discussed. In the framework of this model considered are the e^+e^- annihilation into hadrons, the radiative decays of heavy mesons and the anomalous magnetic moment of a muon. Basing on the method of the finite-energy sum rules the model in question is shown to satisfactorily describe the available experimental data on the e^+e^- annihilation into hadrons, provided the color symmetry breaking occurs at intervals by far exceeding 1 GeV^{-1}. The perturbation theory is shown to be inapplicable to the integral-charge quark model for the calculation of the radiative decays of heavy mesons and the muon anomalous magnetic moment. Description of interactions at large intervals in the framework of broken color symmetry is, after all, reduced (just as in QCD) to the strong interaction problem, i.e. to the problem of total or partial confinement of quarks. The actual value of the integral-charge quark model is the introduction of new, as compared to QCD, degrees of freedom related with the scalar Higgs fields, and the final selection of a model needs a further theoretical analysis of the whole set of experimental data.

6861 (INIS-SU—196, pp 34-36) **Classification of the 4QantiQ-baryons and their decay in statical approximation.** Kulish, Yu.V. 1982. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8105209—No.1(19)).

From All-union seminar electromagnetic interactions of hadrons in the resonance energy range; Khar'kov, Ukrainian SSR (26 May 1981).

4Q anti Q-baryons within the frames of the SU (18, CFY) and SU (6, FJ) groups are considered. It is revealed that 4Q anti Q-baryons belong to 56-, 70 and 1134-plets of the SU (6, FJ) group, the 70- and 1134-plets of the SU (6, FJ) group belonging to one representation of the SU (18, CFJ) group. Amplitudes of meson (on $p\pi^0$ and $peta^0$) and radiation 4Q anti Q-baryon decays belonging to 70-plet SU (6, FJ) and 27-plet of the SU (3, F) group from 1134-plet SU (6, FJ) are calculated.

6862 (INIS-SU—196, pp 87-89) **Weak interaction and scattering of electrons on nuclei.** Moskalev, A.N. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1982. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8105209—No.1(19)).

From All-union seminar electromagnetic interactions of hadrons in the resonance energy range; Khar'kov, Ukrainian SSR (26 May 1981).

The effects of parity nonconservation (EPn-C) under elastic and quasielastic electron scattering on the nuclei associated with weak electron-nucleon and nucleon-nucleon interactions are discussed. Difficulties in EPn-C study due to the nuclear structure dependence are pointed out and the cases when this dependence is absent, which is more favourable for proving the modern theory of weak interactions, are noted.

6863 **Twistor models for elementary particles.** Popovich, A.S. Oxford, England; Oxford University (1980). 241p. British Library, Boston Spa, Wetherby, West Yorks. No. D37334/81.

Thesis.

Steps are taken towards a possible sheaf-cohomological treatment of holomorphic functions of n(> 1) twistors (with particular reference to the n = 2 case). A detailed analysis is given of certain holomorphic differential twistor-operators corresponding to particle observables. The low-lying baryons and baryon resonances are regarded as quark-diquark composites in a six-twistor scheme which also accounts naturally for recently proposed diquark-anti-diquark (or diquonium) composite states. A method for evaluating twistor hadronic matrix-elements is discussed, with particular reference to baryon magnetic moments and baryon semi-leptonic processes. Twistor models closely related to the SU(2)xU(1) Weinberg-Salam and SU(5) Georgi-Glashow models, are constructed using holomorphic functions of three-and six-twistors (respectively). The twistor models have the additional feature of being able to distinguish between distinct lepton and fermion generations. A scheme is considered in which quarks and leptons have a four-twistor description, and are regarded as composites of more fundamental "preon" states.

6454 Field Theory

REFER ALSO TO CITATION(S) 6840, 6841, 6852, 6853

6864 **(INIS-mf—8221) Substructures of quarks and leptons as well as their consequences for the theory of the weak interaction.** Mandelbaum, G. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Physik). 30 Nov 1981. 59p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83703923.

In this thesis first a survey about the possible extensions of the so called standard model of the strong and electroweak interactions is given. Thereafter follows a systematic classification of theoretical approaches to substructure models of quarks and leptons, whereby among others an own model is presented. In the main part of this thesis it is shown who under the assumption of a common substructure of quarks, leptons, and the bosons of the weak interaction a generalized theory of the weak interaction can be formulated, which contains the standard theory of Glashow, Salam, and Weinberg as effective theory in the low energy limit. Both the theoretical differences to the standard model (especially the Higgs mechanism of the spontaneous symmetry breaking is replaced by a dynamic process) and the experimental consequences are elaborated and physically discussed. Finally some of the open questions are discussed in the connection with substructures. (orig.).

6865 **(INIS-mf—8246) Interacting fermions in one spatial dimensions. Thirring, Luttinger, and Heisenberg model.** Wolf, D. (Koeln Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 13 Feb 1982. 128p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83704605.

Thesis.

This thesis contains in its first part a critical survey about the method of the bosonization of fermi fields in one spatial dimension and its application to the Luttinger and the massive Thirring model. The first chapter served for the explanation of the term of the unitary inequivalence. Thereby two generally valid facts could be demonstrated very illustratively by the example of a fermion algebra and its representations, namely first that infinite, direct product space are not separable, and second that weak equivalence of the vacua is equivalent to the unitary equivalence of the corresponding representations of the field algebra. In the second part the statement first studied by Luther (1976) and since then often cited, that the continuum limit of the Heisenberg model is the massive Thirring model. It is concluded that it can up to today not be considered as proved although indications for its validity can be found.

6866 **Superspace geometry of fermionic strings.** Martinec, E. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305 and Laboratory of Nuclear Studies, Cornell University, Ithaca, New York 14853). *Physical Review [Section] D: Particles and Fields;* **28**: No. 10, 2604-2613(15 Nov 1983). Contract AC03-76SF00515.

We calculate the effective action in Polyakov's fermionic-string theory in a manifestly supersymmetric formalism, including the effects of string boundaries. Supersymmetry causes divergence cancellations such that no Liouville interaction term is generated by renormalization of the string fields. For open surfaces, supersymmetry is spontaneously broken by the presence of the boundary, leading to a linear divergence proportional to the length of the boundary.

6867 **Some aspects of the CP/sup N/-1 model.** Samuel, S. (Department of Physics Columbia University, New York, New York 10027). *Physical Review [Section] D: Particles and Fields;* **28**: No. 10, 2628-2636(15 Nov 1983).

The CP/sup N/-1 models are analyzed by embedding them in a generalized two-parameter U(N) vector model. The model is solved in the large-N limit. This allows one to get a better understanding of how well large-N techniques extrapolate to finite N. In contrast to other models, the large-N limit in CP/sup N/-1 models is shown to be more singular. In a lattice version, a phase transition is shown to occur. Elitzur's theorem is also shown to be violated at $N = \infty$. Finally, the large-N limit does not reproduce an interesting property of finite-N CP/sup N/-1 theories. This concept, coined "superconfinment," is defined and examined in detail both mathematically and physically. Why the large-N expansion fails to reproduce it is analyzed by making an analogy with a classical gas system.

6868 **Asymptotic behavior of static meson potentials.** Bolsterli, M. (T Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] D: Particles and Fields;* **28**: No. 10, 2643-2648(15 Nov 1983).

The asymptotic behavior of the source-source interaction energy in static-source meson field theories is shown to be given by the (renormalized) one-meson-exchange interaction. The distorted-field approximation that gives the correct asymptotic behavior also gives a useful approximation to the static meson potential for all values of the source separation.

6869 **Ground state with electromagnetic field and temperature.** Chakrabarti, J. (Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627). *Physical Review [Section] D: Particles and Fields;* **28**: No. 10, 2657-2661(15 Nov 1983). Contract AC02-76ER13065.

We use the background-field method for dealing with the question of phase transition in an atmosphere of external electromagnetic field and temperature. Our approximation methods are somewhat different from earlier works, and we illustrate our procedure by applying to some simple systems. Differences with the earlier approach of summing over vacuum energies are pointed out.

6870 **Automatic U(1) symmetry and invisible-axion models without domain walls.** Kang, K.; Ouvry, S. (Department of Physics, Brown University, Providence, Rhode Island 02912). *Physical Review [Section] D: Particles and Fields;* **28**: No. 10, 2662-2665(15 Nov 1983). Contract AC02-76ER03130.

The concept of automatic symmetry in grand unified theories is explored further in connection with invisible axions, but without suffering from the difficulty of domain walls. We give a procedure to narrow down the Higgs sector by making use of the concept of N-ality in order to accommodate automatic and color-anomalous U(1) symmetries. Furthermore, the condition of no domain walls eliminates many models leaving only a few acceptable. For example, we find that in both SU(7) and SU(9) only one model survives our criteria. The latter one supports the model of Dimopoulos et al., which was based on a specific choice of Higgs scalars.

6871 **Missing charge in the Rubakov process.** Balachandran, A.P.; Schechter, J. (Physics Department, Syracuse University, Syracuse, New York 13210). *Physical Review Letters;* **51**: No. 16, 1418-1421(17 Oct 1983). Contract AC02-76ER03533.

In the scattering of a fermion and a gauge-theory monopole, "charge-mixing" boundary conditions on fermion fields play an important role. The apparent paradox of charge nonconservation suggested by these boundary conditions is shown to be spurious by a careful discussion of gauge invariance, charge, and the monopole state.

6872 **Normal and pion-condensed states in neutron star matter in a relativistic field theory constrained by bulk nuclear properties.** Glendenning, N.K.; Banerjee, B.; Gyulassy, M. (Nuclear Science Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Annals of Physics (New York);* **149**: No. 1, 1-21(Aug 1983). Contract AC03-76SF00098.

A theory of isospin asymmetric matter and of neutron star matter in particular, which is compatible with bulk nuclear properties, is formulated in the framework of a relativistic field theory and solved in the mean field approximation. The self-consistent conditions defining the σ^-, ω^-, π^-, and rho-fields are derived for the normal and the pion-condensed states in explicit form for asymmetric matter, which is in chemical equilibrium, and with prescribed total charge.

6873 **Normal and pion-condensed states in neutron star matter in a relativistic field theory constrained by nuclear bulk properties, II.** Glendenning, N.K.; Hecking, P.; Ruck, V. (Nuclear Science Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Annals of Physics (New York);* **149**: No. 1, 22-43(Aug 1983). Contract AC03-76SF00098.

A relativistic field theory of isospin asymmetric matter and of neutron star matter in particular, which is compatible with nuclear matter bulk properties, was formulated in Part I of this series and treated in mean-field approximation. The self-consistent solutions include the σ, ω, and rho-fields for both the normal and pion-consensed states. The bulk properties of nuclear matter such as saturation density and energy, compressibility and asymmetry energy impose rather stringent restrictions on meson—nucleon coupling constants and the parameters of the nonlinear interactions in the σ-model. The numerical results include the equation of state, particle densities as functions of charge and baryon density and the composition of a neutron star. Based on the these results, we discuss neutron star cooling for various equations of state.

6874 **About characteristics in non-polynomial supersymmetric vector multiplets.** Puzalowski, R. Karlsruhe, Germany, F.R.; Karlsruhe University (T.H.) (1982). 49p. (In German). Library of Karlsruhe Univ. (T.H.) (Germany, F.R.).

The author derives a characteristic equation from which the necessary conditions for causal signal propagation for a general nonlinear supersymmetric theory can be derived. Especially he

finds that the Born-Infeld theory has well properties even in the supersymmetrically extended form. (HSI).

6875 **Topics in quantum theory.** Yuille, A.L. Cambridge, England; Cambridge University (1980). 132p. British Library, Boston Spa, Wetherby, West Yorks. No. D42153/82.

Thesis.

Topics in the Yang-Mills theories of strong interactions and the quantum theories of gravity are examined, using the path integral approach, including; Yang-Mills instantons in curved spacetimes, Israel-Wilson metrics, Kaehler spacetimes, instantons and anti-instantons.

6455 Scattering Theory

6876 (INIS-mf—8672, pp 101) **Spurious binding states in the relativistic three-particle equations.** Garcilazo, H.; Mathelitsch, L. (Graz Univ. (Austria). Inst. fuer Theoretische Physik); Giebnik, L. (Texas A and M Univ., College Station (USA). Dept. of Physics). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6877 **Application of the generator coordinate method to quantum mechanical scattering problems.** Schoeller, O. Frankfurt, Germany, F.R.; Frankfurt Universitaet (1982). 130p. (In German). Library of Frankfurt Univ. (Germany, F.R.).

In this thesis the application fo the Generator coordinate method to the quantum mechanical scattering theory starting from the Hill-Wheeler ansatz is described. In this connection the partial wave expansion is considered. Especially the numerical solution of the Hill-Wheeler equation is described. As numerical examples the s and p wave scattering on a attractive exponential potential and the s wave scattering on a repulsive potential and a Morse potential are considered. (orig./HSI).

65 PHYSICS. II.

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 6546, 6806

6878 **(DOE/ER/40032—4) Nuclear structure at intermediate energies. Progress report, 1983-1984.** Phillips, G.C.; Mutchler, G.S. (Rice Univ., Houston, TX (USA). Bonner Nuclear Labs.). 22 Nov 1983. Contract AS05-81ER40032. 70p. NTIS, PC A04/MF A01. Order Number DE84003439.

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During this reporting period for the 1983-1984 contract year, the analysis and interpretation of several prior experiments were completed. These experiments included π^{+-} elastic scattering from ^{40}Ca and ^{48}Ca (E-80), transverse spin dependence of the proton-proton total cross section (E-504), and the anti p p→ppπ^0 data from E-336 Phase II. In addition, all of the experiments that Rice Faculty participated in at S.I.N. and Saclay have been published or have had manuscripts submitted for publication. These included the measurement of the Axz parameter in the reaction pp→dπ^+ (S.I.N.), angular distributions of the proton polarization analyzing power in anti p p→dπ^+ reaction for 725<E/sub p lab/<1000 MeV (Saclay), and T_{20} in dp elastic scattering near 180° for 300≦E/sub lab/≦2300 MeV (Saclay). A new experiment, E-767, anti N N Annihilation Cross Sections Near Threshold, was mounted at BNL, and a test run was completed. Several spin dependent nucleon-nucleon experiments were carried out at LAMPF with Rice participation. These were The Spin Rotation Parameters D/sub NN/, D/sub SL/, D/sub SS/, D/sub LS/, D/sub LL/, and P for pd Elastic Scattering at 500 and 800 MeV (E-635); D/sub SS/, D/sub LS/, D/sub LL/, and P for pp Elastic Scattering at 699 and 750 MeV (E-636); A Novel Technique for Measuring the Vector Polarization of a Deuteron (E-637); and The Polarization Observables D/sub NN/, P and A for pp→pπ^+n at 800 MeV (E-708). Work continued on predicting the masses and decay widths of the T=1/2, J=1/2$^+$ nucleon states between 1-2 GeV using the M.I.T. bag model expanded to include pions as Goldstone bosons coupled to quarks at the bag surface.

6879 (INIS-mf—8672, pp 102) **Recent problems in nuclear physics.** Eder, G. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6880 **(LA—9841-PR) Applied nuclear data research and development. Semiannual progress report, October 1, 1982-March 31, 1983.** Arthur, E.D. (comp.). (Los Alamos National Lab., NM (USA)). Aug 1983. Contract W-7405-ENG-36. 87p. NTIS, PC A05/MF A01. Order Number DE84003562.

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The activities of the Los Alamos Nuclear Data Group for October 1, 1982, through March 31, 1983, are summarized under the following headings: theory and evaluation of nuclear cross sections; nuclear cross-section processing and testing; fission products and actinides (yields, decay data, depletion and buildup); and neutronics for carbide LMFBR core component development. 103 references.

6512 Nuclear Properties And Reactions, A=1-5, Theoretical

6881 (DOE/ER/40058—1, pp 421-423) **Validity of the evidence for a central depression in the charge density of ^{3}He.** Hadjimichael, E. (Fairfield Univ., CT); Bornais, R.; Goulard, B. 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

The derivation of proton and neutron charge densities from experimentally obtained form factors is considered. The meson exchange current contribution to the ^{3}He charge form factor for three models of neutron and proton charge form factors is calculated and it is shown that it is not valid to use the short range behavior of nucleon charge density to deduce information on the structure of ^{3}He. (KAW)

6882 (DOE/ER/40058—1, pp 488-490) **Electron-deuteron scattering properties of the new Graz separable potential.** Mathelitsch, L.; Plessas, W.; Schwarz, K.; Zingl, H.F.K. (Univ. of Graz, Austria). 1983. NTIS, PC A99/MF A01. (CONF-820475—). Contract AS05-76ER05223.

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

In this contribution we consider the electric form factor A(q), the monopole and quadrupole structure functions, F/sub C/(q) and F/sub Q/(q), and also the tensor polarization T_{20}(q) calculated with the Graz II separable potential. We present the pertinent results calculated with inclusion of pair meson-exchange-current corrections and compare them with the predictions of the Paris '80 potential. It is seen that the new Graz separable potential indeed produces e-d scattering properties in an acceptable manner.

6883 (DOE/ER/40058—1, pp 491-493) **Search for dibaryon signals by the measurement of the tensor polarization t_{20} in π-d polarized scattering.** Ulbricht, J.; Koenig, V.; Grueebler, W.; Chisholm, A.; Schmelzbach, P.A.; Jenny, B.; Sperisen, F.; Elsener, K.; Schweizer, C. (Laboratorium fuer Kernphysik, Eidg. Techn. Hochschule, Hoenggerberg, Zuerich, Switzerland). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

For more than a decade polarization effects in π-d and e-d elastic scattering have been the subject of an intense theoretical investigation. While in the earlier calculation the interest was focused

mainly on the two nucleon interaction such as the D-state probability of the deuteron, recently the interest has been directed toward possible dibaryon resonances in this system. Recently Grein and Locher have calculated a complete set of π-d observables using Faddeev background amplitudes and admixture of $^1D_2$, $^3F_3$ and $^1G_4$ dibaryon resonances. The existence of these three isospin-one resonances has been suggested by the analysis of p-p scattering polarization data. Further evidence came from a measurement of the vector polarization it_{11} in π-d scattering at 256 MeV showing large and fast oscillations, which are quite different from conventional Faddeev predictions. In order to test these findings we have performed measurements of the tensor polarization t_{20} of the recoiling deuteron in π-d elastic scattering at a pion lab energy of 138 MeV. Similar measurements with electrons would be even more interesting. The measurements were carried out using the high intensity πE1 pion channel of the meson facility at the Swiss Institute of Nuclear Research (SIN). Measurements of the t_{20} of the deuterons were taken at the laboratory angular range between 0° and 25° in steps of 5° corresponding to a cm angular range between 130° and 180°.

6884 **(INIS-mf—8225) Measurement of the radius of the nuclear charge distribution of ^{4}He and the radius difference of the He isotopes by electron scattering at small momentum transfer.** Gunten, A. von. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Physik). 9 Jul 1982. 116p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83703926.

At the Darmstadt Linear Accelerator cross sections for the elastic electron scattering on ^{3}He and ^{4}He were measured at energies between 30 and 60 MeV and at scattering angles between 45° and 129°. It deals with relative measurements to the protons respectively with measurements of cross section ratios of ^{3}He to ^{4}He. The main demand of the studies is the acquisition of systematic uncertainties at gas targets. With this the error bounds in the ratios could remarkably be reduced as against earlier electron scattering measurements. At small momentum transfer the rms radius respectively the radius difference is obtained nearly model independently. The uncertainty due to application of a special charge distribution in the evaluation is small as against to the indicated errors. The result are with Rsub(3,4)=<r²sub(3,4)>1/2 and deltaR = R_4 - R_3: R_4 = (1.696+-0.014) fm and deltaR = -(0.271 +- 0.015) fm. (orig.).

6885 (INIS-mf—8672, pp 100) **Measurement of nuclear muon capture in deuterium.** Breunlich, W.H.; Cargnelli, M.; Fuhrmann, H.; Kammel, P.; Marton, J.; Pawlek, P.; Werner, J.; Zmeskal, J. (Oesterreichische Akademie der Wissenschaften, Vienna); Petitjean, C. (Schweizerisches Inst. fuer Nuklearforschung, Villigen); Bertl, W. (Eidgenoessische Technische Hochschule, Zurich (Switzerland)). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6886 (INIS-SU—196, pp 77-79) **Study of quark structure of atomic nuclei.** Inopin, E.V.; Nagornyj, S.I.; Titov, Yu.I. 1982. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8105209—No.1(19)).

From All-union seminar electromagnetic interactions of hadrons in the resonance energy range; Khar'kov, Ukrainian SSR (26 May 1981).

Short-range interactions which are sensitive to the quark structure of atomic nuclei are considered. An experiment for determination of the magnetic form factor of recoil deuterons is suggested and estimated. A model of deuteron electrodisintegration with account of six-quark state is developed. It is revealed that proton yield at large angles at the initial energy above 1 GeV with account of the six-quark state is 1-2 orders higher than the cross section without its allowance.

6887 **Measurement of the proton structure function F_2 in deep inelastic muon-hydrogen scattering.** Wimpenny, S.J. Sheffield, England; Sheffield, University (1981). 332p. British Library, Boston Spa, Wetherby, West Yorks. No. D42479/82.

Thesis.

The structure of the proton was studied by scattering high energy muons off a liquid hydrogen target. The momentum and angle of the incident and scattered muons were measured. Results are presented on the muon proton double differential cross-section, $d^2\sigma\Xi(x,Q^2)/dQ^2,dx$ and the proton structure function $F_2(x,Q^2)$ extracted from data taken at an incident beam energy of 280 GeV and covering the kinematic range of muon energy loss, v from 20 to 270 GeV and four-momentum transfer squared, Q^2 from 2 to 200 GeV/²sub(c). Thus the present data greatly extend the kinematic region over which precise measurements are available.

6513 Nuclear Properties And Reactions, A=6-19 Theoretical

6888 (DOE/ER/40058—1, pp 418-420) **Structure functions in quasi-free (e,e'p) reactions.** Boffi, S.; Giusti, C.; Pacati, F.D. (Instuto di Fisica Teorica dell'Universita, Pavia, Italy). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

The behavior of the structure functions has been investigated for the reaction $^{16}O(e,e'p)^{15}N$ under quasi-free scattering conditions. The effect of different choices of the bound state and of the optical potential is analyzed. The results obtained with the bound state of Elton and Swift and the optical potential of Jackson and Abdul-Jalil are given. The factorization of the f/sub λλ/′ is found largely unsatisfactory but for f_{00}. The transverse form factor f_{11} is dominated by the spin current contribution. f_{01} and f/sub 1-1/ result very sensitive to the optical potential parameters and in particular to the spin-orbit components. The experimental determination of the structure functions is discussed. Ever though a full determination requires experiment under out-of-plane kinematics, the quantities f_{01} and f_{11} can be completely determined in a coplanar kinematical situation. As the exchange currents should mainly affect these functions, their knowledge is essential to clarify the mechanism of the (e,e'p) reaction in the quasi-free-scattering region.

6889 (DOE/ER/40058—1, pp 430-461) **Common ground between hadronic and electromagnetic probes of nuclei.** Bertozzi, W.; Kelly, J.J. (Massachusetts Inst. of Tech., Cambridge). 1983. NTIS, PC A99/MF A01. (CONF-820475—). Contract AC02-76ER03069.

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

Within the regime of direct reactions mediated by local one-body operators, common probes are sensitive to sets of nuclear densities with a large degree of overlap. The reliability of the direct reaction mechanisms for several medium energy probes was verified by phenomenological studies of the 4^- states of ^{16}O and of the octupole states of ^{17}O. However, it was also concluded that while electron scattering may be considered a quantitative probe, its exclusive use can produce misleading structure conclusions. A comparative study of the 4^- states produced a consistent picture of the isospin composition and particle-hole content somewhat at variance with the natural conclusions that might have been drawn from electron scattering alone. A comparison of (e,e′) and (p,p′) in case for which (e,e′) fully specified the require nuclear structure was used to study the two-nucleon effective interaction in the nuclear medium. It was found that the isocalar spin-independent central component of the two-nucleon effective interaction near 150 MeV is strongly dependent upon the local density in the vicinity of the interaction. We also note that the success of the local density approximation holds great promise for the study of the basic two-nucleon interaction. Finally, we have exploited the nonuniform radial sensitivity of the density dependent two-nucleon effective interaction to distinguish between interior and surface modes of excitation.

6890 **(INIS-mf—8250) Emission of light particles in ^{32}S induced reactions.** Winkler, U. (Heidelberg Univ. (Germany, F.R.). Naturwissenschaftlich-Mathematische Gesamtfakultaet). 13 May 1981. 69p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704616.

Thesis.

The reactions $^{32}S + {}^{16}O$, ^{27}Al, and ^{40}Ca were studied at the 221 MeV ^{32}S beam of the MP tandem+postaccelerator combination of the Max-Planck Institute for Nuclear Physics. The experimental methodics consisted of the coincident detection of both heavy reaction products in two large area ionization chambers and two preswitched parallel plate shower counters. The method of analysis used the conservation laws of charge, mass, energy, and momentum in order to calculate from the measured parameters of the heavy fragments their charge, mass, and momentum defects against the incident channel which were caused by emission of light particles. The exit channels show large mean charge defects of 2.01 (^{16}O), 2.94 (^{27}Al), and 4.16 (^{40}Ca) charge units. Two-particle exit channels contribute only to the ^{16}O reactions with about 3%, even three-body exit channels are only found at this system and a charge defect of 2 e. In all other reaction channels more than three reaction channels are present. After the transformation of the momentum defects - i.e. the vector sum of the momenta of the light particles - into the c.m. system no indications for the existence of direct or fast emission processes result. Rather shape and position of the momentum defect distributions can be reproduced by means of Monte Carlo calculations under the assumption of sequential decay mechanisms. For the three-particle exit channels of the ^{16}O reactions which can be identified as sequential α-decays the transformation of the momentum defects to the laboratory system of the emitting nucleus is possible. The fit of Maxwell distributions to the energy spectra of the α particles in the laboratory system yields a mean nuclear temperature of about 2 MeV. From the anisotropy of the angular distributions in the laboratory system angular momenta of the emitting fragments are calculated.

6891 **(INIS-mf—8595) Microscopic description of ^{7}Li and ^{7}Be for the DWBA treatment of cluster transfer reactions.** Pal, K.F.; Lovas, R.G.; Gyarmati, B.; Vertse, T.; Nagarajan, M.A. (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete). 1983. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704613.

The overlap of the α-t interaction times, the ^{7}Li wave function with the product of the α and t wave functions, and the analogous quantity for the charge-conjugate system are calculated on microscopic grounds. This quantity contains the structure information on the ^{7}Li nucleus in the standard finite-range DWBA description of α and t stripping from and pick-up to ^{7}Li. This nucleus is described in the generator-coordinate model assuming the α+t two-cluster structure and schematic nucleon-nucleon forces. The model reproduces the measured g.s. properties reasonably. The microscopic potential overlap is obtained to be very different from those calculated with using local macroscopic α-t interactions, but the difference in the $^{12}C(^{7}Li,t)^{16}O$ cross section is only dramatic at backward angles. To facilitate further DWBA analyses, several versions of the potential overlap as well as the overlap without the potential are given in an easily accessible form.

6892 **(INIS-mf—8597) Quasimolecular and cluster states of light nuclei as examples of intermediate structure.** Cseh, J. (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete). 1983. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704615.

Intermediate structures of nuclear reactions are investigated by analysing experimental data of fragmentation. Two different methods, the MacDonald and the Monahan-Elwyn method were used and compared to obtain the parameters of cluster or quasimolecular intermediate states. 4^+, 6^+ and 8^+ resonances of the $^{12}C+{}^{12}C$ system, $5/2^+$ and $7/2^+$ cluster states of ^{19}F, and O^+ resonances from the α scattering on ^{24}Mg and ^{26}Mg are analysed as intermediate structure data. Parameters of the underlying simple states and the couplings are deduced. Both methods have lead to the same results within the experimental error. Future possible developments of these methods and nuclear theoretical consequences of the results are discussed.

6893 (INIS-SU—196, pp 68-70) **Measuring of gamma spectra at charged π-meson photoproduction on ^{12}C.** Gogifidze, N.Z.; Elissev, A.N.; Kashevarov, V.L.; Pavlyuchenko, L.N.; Rzhanov, E.V.; Rylov, S.V.; Smirnov, P.A.; Sokol, G.A.; Fomenko, A.M. (AN SSSR, Moscow. Fizicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8105209—No.1(19)).

From All-union seminar electromagnetic interactions of hadrons in the resonance energy range; Khar'kov, Ukrainian SSR (26 May 1981).

The results of measuring energy spectrum of nuclear quanta on ^{12}C are presented. Gamma-quanta have been measured in the 0.4-3 MeV range, energy resolution have constituted $\Delta E = +\text{-}4.0$ keV. The following series of γ-lines is singled out in the spectrum: 0.480 MeV - $^{7}Li^*$; 0.950 MeV - $^{12}B^*$, 0.980 MeV - $^{8}Li^*$ emitted by excited nuclei arising at π-meson photoproduction on ^{12}C, annihilation γ-line of 0.511 MeV. A series of γ-lines: 0.596 MeV - ^{74}Ge, 0.868 MeV - ^{72}Ge, 0.881 MeV - ^{206}Pb, 0.897 MeV - ^{207}Pb resulted from (n, γ) and (n, n'γ)-reactions in the Ge-detector and Pb-protection is revealed.

6894 **Particle correlations in proton—nucleus and nucleus—nucleus collisions.** Nagamiya, S. (Lawrence Berkeley Laboratory, University of California, Berkeley; Department of Physics, University of Tokyo, Hongo, Bunkyo-ku, Tokyo, Japan). *Soviet Journal of Particles and Nuclei;* **14**: No. 3, 238-252(May 1983). Contract W-7405-ENG-48.

Experimental studies on particle correlations in proton—nucleus and nucleus—nucleus collisions at beam energies of 1—2 A GeV are reviewed. Data are categorized into two types. One is those which provide fundamental information on the basic reaction mechanism. For example, the nucleon mean free path, the interaction radius, the fraction of the direct knock-out component, the pion-to-proton ratio, and the role of clusters in backward proton emission have been studied. The other is the data that have not yet been explained within the framework of orthodox theories. Hints of hydrodynamical flows are observed in these data. Finally, future experimental possibilities are discussed.

6895 **Search for isovector M1- and M2-transitions in ^{17}O and ^{18}O by high resolution electron scattering on gas targets.** Bender, D. Darmstadt, Germany, F.R.; Technische Hochschule (1982). 108p. (In German). Library of Technische Hochschule Darmstadt (Germany, F.R.).

For the high resolution electron scattering facility of the Darmstadt Linear Accelerator a high pressure gas target system was developed. Experiments on the nuclei ^{17}O and ^{18}O with this target system served for the search for magnetic dipole and quadrupole transitions to Tsub(>) states. In ^{17}O the excitation of the states at 11.08 MeV (Jsup(π)=$1/2^-$), 12.47 MeV (Jsup(π)=$3/2^-$), 13.00 MeV (Jsup(π)=$5/2^-$), 14.23 MeV, 14.75 MeV, and 15.10 MeV could be observed. The uptake of fire spectra at momentum transfer between 0.3 fm^{-1} and 0.5 fm^{-1} allowed the determination of the magnetic quadrupol strength to the states at 14.23 MeV and 14.75 MeV as B(M2)up = 46+-7 μsub(N)^2 fm^2 respectively B(M2)up = 27+-9 μsub(N)^2 fm^2. The transition to 15.10 MeV possesses a magnetic dipol strength of B(M1)up = 0.14+-0.04 μsub(N)^2. The studies on ^{18}O were concentrated on the excitation energy range between 16 MeV and 19 MeV. The ten uptaken spectra cover a range of the momentum transfer between 0.3 fm^{-1} and 0.5 fm^{-1}. Two transitions at Esub(x) = 16.399+-0.005 MeV (Jsup(π)=2^-) and Esub(x)=18.871+-0.005 MeV (Jsup(π)=1^+) dominate the spectra. The corresponding strengths are B(M2)up = 58+-8 μsub(N)^2 fm^2 and B(M1)up = 0.28+-0.04 μsub(N)^2. (orig./HSI).

6896 **Gamma decay of virtual states in ^{20}Ne and ^{16}O excited in radiative alpha-particle capture.** Hurst, M.J. Oxford, England; Oxford University (1980). 290p. British Library, Boston Spa, Wetherby, West Yorks. No. D37312/81.

Thesis.

A cryogenically pumped, windowless gas target has been used to study the radiative alpha-capture reaction on ^{16}O and ^{12}C targets, giving information on the electromagnetic decay properties of various unbound states in ^{20}Ne and ^{16}O. Several states in ^{20}Ne have been observed in this reaction for the first time. The first five unit-isospin, natural parity states in ^{20}Ne have been observed. Five zero-isospin capture resonances in ^{20}Ne have been studied, the gamma-decay of the 8.70 MeV (1^-), 9.11 MeV (3^-) and 11.92 MeV (4^+) states being observed for the first time. A remeasurement has been made of the enhanced E2 decay strength of the 8^+ member of the ground state rotational band, giving sup(ωlambda)=131+-18 meV, in agreement with a previous less accurate value. This result

is compared with shell model calculations. A study of the capture reaction on ^{12}C has been performed in the beam energy range 5.22 MeV < Eα < 9.53 MeV. No new capture resonances have been found but the known inelastic resonances have been seen. The 11.10 MeV (4^+) state has been studied and the strength for the decay to the 6.13 MeV (3^-) state has been shown to be only half of a previous result. The 12.05 MeV (0^+) state has not been observed, but a limit has been placed on its strength.

6514 Nuclear Properties And Reactions, A=20-38, Theoretical

6897 **(INIS-mf—8251) Study of continuous spectra of scattered α and ^{6}Li particles at 26 MeV/A by detection of coincident γ-radiation.** Nitsche, W. (Heidelberg Univ. (Germany, F.R.). Naturwissenschaftlich-Mathematische Gesamtfakultaet). 1981. 93p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83704617.

Thesis.

In a particle-γ coincidence experiment with a new developed correlation chamber the excitation and the subsequent particle decay of the nuclear continuum (up to 70 MeV excitation energy) and isoscalar giant quadrupole resonance in the nuclei ^{28}Si, ^{27}Al, ^{58}Ni, and ^{62}Ni is studied by the detection of discrete γ-transitions in the daughter nuclei. The excitation is performed by inelastic scattering of α particles on ^{28}Si, ^{58}Ni, and ^{62}Ni at an incident energy of 104 MeV and of ^{6}Li particles on ^{28}Si and ^{27}Al at 156 MeV (26 MeV/A). The measured particle-γ angular correlations are compatible with isotropic γ-decay. The α spectrum coincident with ^{6}Li ejectiles shows in the case of the ^{28}Si target only strong photo lines of the 1 -> 0 (transitions from the 1. excited to the ground state) transition in ^{28}Si, ^{27}Si, ^{27}Al, and ^{24}Mg and 2 -> 0 transitions in ^{27}Al and ^{27}Si. In the α-induced γ-spectrum beyond many lines of low lying transitions in nuclei with a mass number A = 20 to 26 are found which follow the emission of several nucleons. The interpretation is performed in the framework of Hauser-Feshbach evaporation calculations which describe the dissipative part of the continuum and calculation in PWIA approximation which describe fast direct nucleon respectively α-particle knock-out processes.

6898 (INIS-mf—8672, pp 101) **Cluster approximation for the elastic pion-nucleus scattering.** Leeb, H. (Technische Univ., Vienna (Austria). Inst. fuer Experimentelle Kernphysik); Schmid, E.W. (Tuebingen Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6515 Nuclear Properties And Reactions, A=39-58, Theoretical

6899 (DOE/ER/40058—1, pp 572-574) **Importance of the pre-equilibrium process in the photoproton decay of the ^{45}Sc giant dipole resonance.** Van de Vyver, R.; Ryckbosch, D.; Van Camp, E.; Kerkhove, E.; Van Otten, P.; Berkvens, P. (Ghent State Univ., Belgium). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

Absolute cross sections for the ground state and for various semi-direct ^{45}Sc(γ,p) reaction channels were determined. The direct, pre-equilibrium and equilibrium contributions to the photoproton decay of the GDR equal about 35, 20 and 45% respectively of the total energy-integrated (γ,p) cross section. The predictions of the exciton model agree qualitatively with our experimental results.

6900 **(FRNC-TH—1170) Nuclear density measurement using heavy ion elastic scattering near the Coulomb barrier.** Cusset, E. (Paris-11 Univ., 91 - Orsay (France)). 1981. 56p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84700524.

The angular distributions are measured for α on ^{48}Ti, ^{62}Ni, ^{90}Zr and ^{120}Sn at 12, 13, 16 and 18 MeV respectively, ^{16}O on the same at 41, 46, 57 and 64 MeV respectively, and ^{14}N, ^{16}O, ^{24}Mg, ^{26}Mg and ^{28}Si on ^{48}Ti at 34, 38, 66 and 78 MeV respectively. The experimental equipment is described, and the results are analysed, both with the optical models and the Saxon-Woods potentials and with the convolution model.

6901 **Measurement of the magnetic moments of short-lived states in some medium-light nuclei.** Murphy, B.J. Oxford, England; Oxford University (1980). 239p. British Library, Boston Spa, Wetherby, West Yorks. No. D37325/81.

Thesis.

An extension of the recoil in vacuum technique to short-lived states in medium-light (Z approx. = 20) ions with approx. 10-20 ionic electrons is described. Sup(54,56,58)Fe(2_1^+) and sup(46,48,50)Ti(2_1^+) states were Coulomb-excited by ^{28}Si and ^{32}S beams and the hyperfine attenuated γ-ray angular correlations, detected in coincidence with back-scattered particles, was measured for ^{56}Fe and ^{48}Ti as a function of time after leaving the foil and for all isotopes as a function of recoil velocity (in the range 0.01c-0.04c). The hyperfine interaction was found to be essentially static over the lifetime (approx. = 1-10ps) of the states. Analysis of the attenuation in Fe, using a microscopic model of the hyperfine fields, reproduced the known Fe g-factors with up to 15% accuracy. The analysis was shown to be largely insensitive to the assumed distribution of fields.

6516 Nuclear Properties And Reactions, A=59-89, Theoretical

6902 **(CONF-821143—12) High spin states and the competition of spherical and strongly deformed shapes in the A = 70 to 80 region.** Hamilton, J.H.; Ramayya, A.V.; Piercey, R.B.; MaGuire, C.F.; Barclay, M.; Ma, W.C.; Robinson, R.L.; Roth, J.; Cleemann, L.; Eberth, J. (Vanderbilt Univ., Nashville, TN (USA). Dept. of Physics; Oak Ridge National Lab., TN (USA); Koeln Univ. (Germany, F.R.)). 1982. Contract W-7405-ENG-26. 14p. NTIS, PC A02/MF A01. Order Number DE84003364.

From High angular momentum properties of nuclei conference; Oak Ridge, TN, USA (2 Nov 1982).

Portions are illegible in microfiche products.

A wide variety of collective band structures are seen in Ge to Sr nuclei to make this an important new testing ground for nuclear models. These include bands built on coexisting and competing near-spherical and deformed shapes, γ vibrational bands and multiple positive and negative parity bands. Ground state bands in Ge and Kr but not $^{78\ 80}$Sr are crossed at the 8^+ to 12^+ levels. Gaps in the Nilsson levels for both N and Z = 38 at large deformation lead to large ground state deformation in Kr and Sr around N = 38. The crossing of rotation aligned bands based on (g/sub 9/2/)^2 configuration are correlated with the ground state deformations. A second high spin crossing is seen in ^{74}Kr. Measured g factors in ^{68}Ge yield a two-quasineutron structure for the 8_2^+ state. 30 references.

6903 **(DOE/ER/02408—217) Structure of low-lying states of $^{76\ 78\ 80\ 82}$Se deduced from (p vector,p') scattering at 16 MeV.** Delaroche, J.P.; Varner, R.L.; Clegg, T.B.; Anderson, R.E.; Burks, B.L.; Ludwig, E.J.; Wilkerson, J.F. (North Carolina Univ., Chapel Hill (USA). Dept. of Physics and Astronomy; Triangle Universities Nuclear Lab., Durham, NC (USA)). 1982. Contract AS05-76ER02408. 52p. (ORO—2408-217). NTIS, PC A04/MF A01. Order Number DE84004053.

Angular distributions of dσ/dΩ and A/sub y/ have been obtained for elastic and inelastic scattering of 16-MeV protons leading to the first two 2^+ states and the lowest excited 0^+, 4^+ and 3^- levels of $^{76\ 78\ 80\ 82}$Se. Results have been analyzed in the coupled channels framework assuming the Vibrational Model, the Rotation-Vibration Model, the Asymmetric Rotational Model (ARM) and its extension to β-vibrational states. There is no one model which can describe simultaneously all the data. However, we find from our ARM-based analysis, which provides the best overall description of the even-parity states, evidence for different deformation for the first

and second 2^+ states. This suggests shape coexistence phenomena in these nuclei. Also we observe that the nuclear structure of ^{82}Se seems to be quite different from that of the lighter isotopes studied. We find, too, that the 3^- levels of $^{76\ 78\ 80}$Se do not behave as simple vibrational octupole states. Nuclear deformations extracted from the present measurements have been compared with those from earlier (n,n') scattering and Coulomb excitation measurements. Finally, the need for complex and/or deformed spin-orbit potentials is discussed. 47 references.

6904 (DOE/ER/40058—1, pp 569-571) **Decay of the T/sub >/ giant dipole resonance in ^{89}Y.** Van Camp, E.; Van de Vyver, R.; Ryckbosch, D.; Kerkhove, E.; Van Otten, P.; Berkvens, P. (Ghent State Univ., Belgium). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

Short lived dipole states act as doorways to the underlying much more complicated degrees of freedom of the nucleus. During this dissipation process, isospin symmetry breaking in nuclear systems, mainly due to the Coulomb interaction, causes decay into channels that are otherwise closed. This is the case for the (γ,n) decay of the T/sub >/ GDR in ^{89}Y, from which the isospin mixing of the underlying T/sub >/ compound states can be deduced. In order to obtain information about the direct coupling of the T/sub >/ resonance with the continuum and about the spreading of the T/sub >/ dipole strength over the other degrees of freedom, followed by isospin mixing and statistical decay, cross sections were measured for both direct and non-direct (γ,p) channels. In our experiments three direct proton decay channels could be identified for both isospin states (Table 1), as well as the photoprotons originating from statistical decay. The data show the existence of the T/sub </ and T/sub >/ dipole resonances located at 16.8 and 21.5 MeV respectively, both having a width Γ/sub </ $\approx$ Γ/sub > $\approx$ 4 MeV and a strength ratio S/sub >//S/sub < = 0.13 +- 0.02 which is in agreement with the theoretical estimate of Fallieros and Goulard.

6517 Nuclear Properties And Reactions, A=90-149, Theoretical

6905 (CONF-830970—5) **Heavy ion excitation and photon decay of giant resonances.** Bertrand, F.E.; Beene, J.R.; Sjoreen, T.P. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 17p. NTIS, PC A02/MF A01. Order Number DE84003287.

From International symposium on highly excited states and nuclear structure; Orsay, France (5 Sep 1983).

Results are presented for excitation of giant multipole resonances by inelastic scattering of 350 and 500 MeV ^{16}O projectiles from ^{90}Zr and ^{208}Pb. The giant quadrupole resonance is excited with large cross sections and a very large resonance peak to continuum ratio is obtained. Extracted cross sections agree with DWBA calculations which use standard collective model form factors. Using 380 MeV 170 to excite the giant resonances, the γ-ray decay has been measured for the giant quadrupole resonance region of ^{208}Pb. 10 references.

6906 (INIS-mf—8245) **Collective charge and mass transfer in heavy ion reactions.** Hahn, J. (Frankfurt Univ. (Germany, F.R.). Fachbereich Physik). 8 Feb 1982. 120p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83704612.

Thesis.

In this thesis the dynamics of the charge and mass asymmetry degree of freedom was studied in the framework of the fragmentation theory by means of a time-dependent Schroedinger equation. New is the introduction of a friction potential which describes the coupling of these collective degrees of freedom to the not explicitly treated other collective respectively internal degrees of freedom. Thereby it was shown that the measured widths of the isobaric charge distributions in the ^{86}Kr+sup(92,98)Mo reaction can be explained mainly by the quantum mechanical uncertainty in the charge asymmetry degree of freedom. The charge equilibration occurring at the begin of a deep inelastic collision can therefore by considered as a quantum mechanical, collective, damped motion which is connected with the excitation of the isovector giant dipole resonance of the nucleus-nucleus system. The study of the mass transfer in the reactions ^{132}Xe+ ^{120}Sn and ^{86}Kr+ ^{166}Er shows how important, at the beginning of a deep inelastic collision, shell structures and their conservation are for a large part of the reaction, even if the elemental distribution show no maxima in the region of magic shell closures. The experimental width are up to 10 MeV/A well described under conservation of the shell structure.

6907 (INIS-mf—8253) **γ-spectroscopic study of the structure of medium-heavy nuclei far from beta stability.** Andersson, C.E. (Heidelberg Univ. (Germany, F.R.). Naturwissenschaftlich-Mathematische Gesamtfakultaet). 1981. 107p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE83704619.

Thesis.

The aim of this study is to extend the existing nuclear spectroscopic information in the Zapprox.=50 isotopes near the stability line, to the proton-rich "white" region of the nuclide chart. This has been done with respect both to the coexistence of single particle states and collective rotational bands and to the strength distribution in the beta decay. The beta strength function is of general importance for various fields in nuclear physics and astrophysics. In the first part of this work, investigations of high spin states in neutron deficient nuclei around Z=50 by γ-spectroscopic methods are described. High spin states in ^{108}Sn, ^{107}In and ^{108}In were studied by the reaction ^{92}Mo(^{19}F,xyzγ). The experiments were performed at the MP Tandem accelerator at the Max-Planck-Institut fuer Kernphysik in Heidelberg. For the reduction of the Compton background in the spectra a Compton suppression spectrometer was used. A large number of new high spin states has been found in the studied nuclei and the systematic behaviour of the level pattern is discussed. In sup(107,108)In rotational-like band structures are observed whereas the yrast states in ^{108}Sn are suggested to be four-quasiparticle states. In the second part the results from a γ-spectroscopic study of the β^+ strength function Ssub(β)+ are presented for the β decay of neturon deficient Ba and Cs nuclei. Information on the structure of Ssub(β) existed up to now for the Ba isotopes, only beyond the proton binding energy from β-delayed proton experiments. The beta decay of ^{121}Ba, ^{123}Ba, sup(120m+g)Cs and sup(121m+g)Cs was studied by the reactions sup(92,94)Mo(^{32}S,xyzγ). For these nuclei a total number of about 150 new γ transitions has been identified in this work. The observed shapes of Ssub(β) are consistent with the structure expected from shell model and RPA calculations.

6908 (JAERI-M—83-127) **Theoretical calculation of decay data of short-lived nuclides for JNDC FP Decay Data File.** Yoshida, T. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Aug 1983. 58p. (NEANDC(J)—92/U; INDC(JAP)—79/L). Information Section, Division of Technical Information, Japan Atomic Energy Research Institute, Tokai-mura, Naka-gun, Ibaraki-ken 319-11, Japan.

It is one of unique features of the JNDC FP Decay Data File that theoretical values of anti E/sub β/ and anti E/sub γ/, average beta- and gamma-ray energies, are fully adopted for short-lived nuclides. Here, details of the theoretical estimation method of anti E/sub β/ and anti E/sub γ/ based on 'gross theory' of beta-decay are described and the numerical tables of the estimated decay data for short-lived nuclides are presented. Further, discussion is made for justification of adoption of the theoretical values instead of values derived from decay schemes from the viewpoint of the energy profile of the beta-strength function. 39 references.

6909 **Fine structure and spin excitations in the giant resonance region of ^{90}Zr.** Nanda, S.K.; Glashausser, C.; Jones, K.W.; McGill, J.A.; Carey, T.A.; McClelland, J.B.; Moss, J.M.; Seestrom-Morris, S.J.; Ohnuma, H.; Franey, M. (Rutgers University, New Brunswick, New Jersey 08903). *Physical Review Letters;* **51**: No. 17, 1526-1529(24 Oct 1983).

Cross sections, analyzing powers, and spin-flip probabilities have been measured at small angles in the reaction ^{90}Zr(p,p')^{90}Zr* at 319 MeV. A rich fine structure is observed in the previously proposed M1 giant resonance region; angular distributions of most of these structures are consistent with M1 excitation. The spin-flip

measurements reveal a large cross section for spin excitations distributed roughly uniformly over the excitation energy region from about 8 to 25 MeV.

6910 **Nuclear data sheets for A = 137.** Peker, L.K. (National Nuclear Data Center, Brookhaven, National Laboratory, Upton, New York 11973, USA). *Nuclear Data Sheets;* **38**: No. 1, 87-184(Jan 1983). Contract AC02-76CH00016.

The experimental nuclear structure data available through October 1981 have been reviewed. A summary of information obtained in various reaction and decay experiments is presented, together with adopted level schemes.

6911 **Nuclear spectroscopy studies of neutron rich even-even cerium isotopes.** Michelakakis, E.E. Brighton, England; Sussex University (1981). 221p. British Library, Boston Spa, Wetherby, West Yorks. No. D42672/82.

Thesis.

The delta-delta directional correlation technique has been used to assign spins and, indirectly, parities to the excited states of the sup(140,142,144)Ce isotopes, populated by the β-decay of the sup(140,142,144)La nuclei, and for multipole mixing ratio measurements. Coincidence data were analysed for selected gates and formed the basis for constructing extensive level schemes for sup(142,144)Ce nuclei. The low-lying excited states of the cerium isotopes have been established and their electromagnetic properties and the phase transition to the deformed "lanthanide" nuclei are investigated. The onset of deformation has been identified and the connection with the other light "rare earths" and the barium isotopes is discussed. The present experimental data are compared with the theoretical predictions of the Shell- and Interacting Boson Approximation-models, the semi-magic ^{140}Ce nucleus with the former and the transitional sup(142,144)Ce nuclei with the latter.

6518 Nuclear Properties And Reactions, A=150-189, Theoretical

6912 **(INIS-mf—8252) Study of central collisions between high energetic heavy ions.** Mueller, W.F.J. (Heidelberg Univ. (Germany, F.R.). Naturwissenschaftlich-Mathematische Gesamtfakultaet). Oct 1981. 62p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704618.

Thesis.

At the CERN-SC an experiment for the study of the reaction mechanism in heavy ion collision at incident velocities above the Fermi velocity was performed. Thereby targets of ^{181}Ta, ^{197}Au, and ^{238}U were irradiated with ^{12}C ions of 86 MeV/u and partly 58 MeV/u. The experimental setup should yield an at most comprehensive survey over the reaction channels. Large area counter systems for the detection of projectile and target fragments were developed. In coincidence for this small counters with good resolution and particle identification were operated. By the detection of the target fragments in a large spatial angle it could be shown that for the reaction ^{12}C + ^{238}U the binary fission is the dominant channel for the decay of the residual target nucleus. From the angular correlation of the fission fragments the momentum transfer to the target nucleus can be determined. By this a discrimination between peripheral and central collisions is possible. From the multiplicity and type of the projectile fragments furthermore can be concluded on the impact parameter. The multiplicity of the emitted light particles (p, α) under 45° and 135° refers to the deposed energy. A strong dependence of the multiplicities and angular distributions on the momentum transfer to the target nucleus is observed. The mechanisms dominant for the different impact parameter regimes are discussed. The emission of medium heavy fragment (C..Ca) could be detected in coincidence with two fission fragments. A break up of the residual target nucleus in 4 or more fragments heavier than carbon was not found.

6913 **Shell-model description of the low-energy structure of strongly deformed nuclei.** Draayer, J.P.; Weeks, K.J. (Department of Physics and Astronomy, Louisiana State University, Baton Rouge, Louisiana 70803). *Physical Review Letters;* **51**: No. 16, 1422-1425(17 Oct 1983).

An effective fermion interaction of maximum particle rank four, comprised of operators which form the integrity basis of an SU(3)→R(3) algebra, has been found sufficient to reproduce almost exactly, within a single leading irreducible representation of pseudo SU(3), the ground- and gamma-band rotational structure as well as the concomitant interband and intraband B(E2) strengths of states in the strongly deformed nuclei. Results are given for ^{164}Er.

6519 Nuclear Properties And Reactions, A=190-219, Theoretical

6914 (INIS-SU—196, pp 80-82) **Search for fission channel of heavy hypernuclei decay.** Inopin, E.V.; Noga, V.I.; Pashchuk, S.A.; Ranyuk, Yu.N.; Rutkevich, N.Ya.; Sorokin, P.V. 1982. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8105209—No.1(19)).

From All-union seminar electromagnetic interactions of hadrons in the resonance energy range; Khar'kov, Ukrainian SSR (26 May 1981).

An attempt is made to discover fissile hypernuclei among the products of 1.45 GeV electron interaction with bismuth nuclei using solid-state track detectors. Cases of delayed fission with life time 1.5 orders exceeding that of the hyperon are revealed in the experiment. Additional investigations are presupposed for final identification of the revealed delayed fission with hypernucleus fission.

6915 **Large cross sections for quasielastic neutron pickup reactions induced by ^{37}Cl, ^{48}Ti and ^{58}Ni on ^{208}Pb.** Rehm, K.E.; Kovar, D.G.; Kutschera, W.; Paul, M.; Stephans, G.; Yntema, J.L. (Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review Letters;* **51**: No. 16, 1426-1429(17 Oct 1983). Contract W-31-109-ENG-38.

Large cross sections for neutron-pickup reactions have been observed for ^{37}Cl, ^{48}Ti, and ^{58}Ni+ ^{208}Pb at incident energies of 250, 300, and 375 MeV, respectively. These reactions, which occur with energy losses of only ~5 MeV, contribute about 25% to the total reaction cross section.

6520 Nuclear Properties And Reactions, A=220 And Above, Theoretical

6916 **(INIS-mf—8229) Measurement of positron spectra after heavy ion collisions with special weighting of the data processing.** Weik, F. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Physik). 30 Jan 1981. 87p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83703922.

The measurement of positron spectra of the supercritical ^{238}U - ^{238}U system is described, at which the 1ssub(sigma)-level should dip into the negative energy continuum. For the comparison the measurement of the subcritical ^{238}U - ^{208}Pb and the nuclear system ^{238}U - ^{108}Pd are used. All measurements were performed at 5.9 MeV/A. For the detection of the positrons a solenoid transport system with 2 Si(Li) diodes as energy determining elements and with 4 NaI crystals for the identification by the 511 keV annihilation radiation in coincidence were used. The electronics, the data acquisition on the base of a process computer with coupling to an IBM computer and the analysis are extensively described. To this belongs also an unfolding procedure of a model response function for positron and gamma spectra. The unfolded positron spectra were corrected under assumption of E1-Conversion coefficients to the nuclear contribution which were fitted to the ^{238}U - ^{108}Pd system. The positron spectrum of the supercritical ^{238}U - ^{238}U shows no evident indication which may lead to the conclusion of a dipping of the 1ssub(sigma) level. (orig.).

6917 **(LA—9873-MS) Evaluation of n + ^{239}Pu nuclear data for revision 2 of ENDF/B-V.** Arthur, E.D.; Young, P.G.; Madland, D.G.; MacFarlane, R.E. (Los Alamos National Lab., NM (USA)). Oct 1983. Contract W-7405-ENG-36. 47p. NTIS, PC A03/MF A01. Order Number DE84003559.

A major revision of the ENDF/B-V evaluation of neutron-induced nuclear data for ^{239}Pu has been completed. The most important changes to the evaluation include incorporation of a comprehensive new theoretical analysis based on recent experimental data to replace part of the total cross-section file and all of the elastic and inelastic cross sections and secondary distributions between ~ 10 keV and 20 MeV; reevaluation of the prompt and total average neutron multiplicites from fission for incident energies between 0.4 and 11.5 MeV to correct discrepancies of almost 3% with new experimental data; and the replacement of all secondary neutron energy spectra from fission with improved shapes based on approximations to a new theoretical method. The evaluation has been tested by calculating various experimental results for five fast critical assemblies. Because major data types were either not thoroughly analyzed or were simply carried over from ENDF/B-V, this evaluation is regarded as an interim replacement until a more careful study can be done for ENDF/B-VI. The results of the new evaluation are being distributed as Revision 2 of ENDF/B-V by the National Nuclear Data Center at Brookhaven National Laboratory. A second version of the evaluation that includes a more complete description of the incident-energy-dependent fission neutron spectra has also been provided to the ENDF/A library at Brookhaven. 46 references.

6918 **First observation of backbending in an actinide nucleus.** Spreng, W.; Azgui, F.; Emling, H.; Grosse, E.; Kulessa, R.; Michel, C.; Schwalm, D.; Simon, R.S.; Wollersheim, H.J.; Mutterer, M. (Gesellschaft fuer Schwerionenforschung, D-6100 Darmstadt, Federal Republic of Germany). *Physical Review Letters;* **51**: No. 17, 1522-1525(24 Oct 1983).

The yrast bands in ^{242}Pu and ^{244}Pu have been studied up to spin 26^+ by Coulomb excitation by use of ^{208}Pb beams of 5.1 and 5.3 MeV/u. In the case of ^{244}Pu a pronounced backbending has been observed for the first time in an actinide nucleus. Microscopic calculations are presented which indicate that the observed anomalies in the yrast sequence of both nuclei are due to alignment effects in the i/sub 13/2/ proton shell.

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 6832, 6832, 6833, 6872, 6873

6919 **(CONF-8311106—1) Effect of the Δ(1236) resonance on magnetic dipole properties of nuclei.** Lawson, R.D. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 13p. NTIS, PC A02/MF A01. Order Number DE84003606.

From International symposium on electromagnetic properties of atomic nuclei; Tokyo, Japan (9 Nov 1983).

The effect of the Δ(1236) resonance on magnetic moments, M1 transition rates and beta decay is discussed. The main effect of including this resonance is to renormalize the g-factor of the valence nucleons and explicit values for this renormalization are given. The effect on l-forbidden M1 transitions is investigated.

6920 **(DOE/ER/10419—3) Research in theoretical nuclear physics. Progress report.** Robson, D. (Florida State Univ., Tallahassee (USA). Dept. of Physics). 1983. Contract AS05-79ER10419. 10p. NTIS, PC A02/MF A01. Order Number DE84003442.

The general philosophical basis for the work described has been to examine calculable quark dynamical models based on intuitive methods of including the major effects from QCD. We have not begun really large scale calculations of light nuclei based on a given model simply because we believe it is necessary to survey first what should be the important ingredients of any model. Each of the thrusts tackled this year, although at first sight appearing to be fragmentary, are actually all possible ingredients to be surveyed as interrelated components of a model to be used in larger scale calculations. In the first year of the present three year contract there have been several major thrusts: (1) the relativistic Salpeter equation has been solved for various Lorentz-Dirac types of potentials for heavy q anti q systems; (2) the two-gluon virtual annihilation mechanism as a source of the π^0-eta-eta′ mass differences has been investigated using a fully relativistic on the energy shell Feynmann graph; (3) comparison of several hadron-hadron interactions using the conventional quark (two-body potentials) dynamics up to 2 bar $h\omega$ has been made; and (4) an alternative quark dynamics incorporating orthogonality constraints consistent with local color gauge invariance has been formulated. The significance of each of these achievements is outlined. (WHK)

6921 (DOE/ER/40058—1, pp 1-36) **Where is electron physics now and where is it going.** Drechsel, D. (Johannes Gutenberg-Universitaet, Mainz, Germany F.R.). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

The present status and proposals for future developments of nuclear structure investigations with electromagnetic interactions are reviewed. Topics include a brief history of the field, a comparison of various classes of experiments, selected results on ground and excited state properties of light and complex nuclei. The role of coincidence experiments as tools to solve longstanding puzzles and to explore new phenomena is emphasized. Finally, the requirements for the new generation of accelerators and particle detection systems are summarized.

6922 (DOE/ER/40058—1, pp 37-60) **Outstanding theoretical questions.** Gross, F. (Carnegie-Mellon Univ., Pittsburgh, PA). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

Three current problems in nuclear physics are considered. First applications of quark-bag models to nuclear structure, including the effect of bag radius on exchange potentials and the existence of color components ion nuclear states, are discussed. Next relativistic effects in two and three body systems are considered. Lastly, problems related to theoretical interpretation of electromagnetic interactions at high momentum transfer are reviewed. (KAW)

6923 (DOE/ER/40058—1, pp 77-107) **Crucial questions in nuclear structure.** Zamick, L. (Rutgers Univ., Piscataway, NJ). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

The following problems in nuclear physics are reviewed and discussed: (1) interpretation of electromagnetic form factors from electron scattering data; (2) double beta decay; (3) electron scattering and nuclear correlations; (4) prediction of new giant resonances from harmonic oscillator models and (5) sum rules for inelastic electron scattering. (KAW)

6924 (DOE/ER/40058—1, pp 108-169) **Nuclear physics as a relativistic quantum field theory.** Jaminon, M.; Mahaux, C. (Universite de Liege, Belgium). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

We describe a phenomenological relativistic shell model, and we compare its main features with those of the phenomenological nonrelativistic shell model. We then confront with the experimental data some of the predictions of this relativistic shell model; we successively consider the charge distribution, the electron double-differential scattering cross sections, the energy dependence of the depth of the central part of the Schroedinger-equivalent potential, the single-particle energies and the spin-orbit coupling strength, the magnetic dipole moments, the weak coupling constants and the pion production cross section. Nuclear matter and some approaches to the theoretical justification of the phenomenological relativistic shell model are described. We successively survey the mean field, Hartree, Hartree-Fock and Brueckner-Hartree-Fock approximations. The microscopic approaches in the case of finite nuclei are then discussed.

6925 (DOE/ER/40058—1, pp 170-208) **Nuclear chromodynamics.** Brodsky, S.J. (Inst. for Advanced Study, Princeton, NJ). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

The fact that QCD is a viable theory for hadronic interactions implies that a fundamental description of the nuclear force is now possible. Although detailed work on the synthesis of QCD and nuclear physics is just beginning, it is clear from the structure of QCD that several traditional concepts of nuclear physics will have to be modified. These include conventional treatments of meson and baryon-pair contributions to the electromagnetic current and analyses of the nuclear form factor in terms of factorized on-shell nucleon form factors. On the other hand, the reduced nuclear form factors and scattering matrix elements give a viable prescription for the extrapolation of nuclear amplitudes to zero nucleon radius. There is thus the possibility that even the present phenomenology of nuclear parameters will be significantly modified.

6926 (DOE/ER/40058—1, pp 209-237) **Meson exchange and quark pairing.** Weber, H.J. (Univ. of Virginia, Charlottesville). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

A quark pairing mechanism is reviewed that generates the strong interactions of meson exchange character. It originates from quark (or antiquark) reflections in the color confining hadronic surface region and proceeds by quark exchange scattering in conjunction with quark-antiquark condensate propagation across the QCD vacuum. This mechanism links chiral invariance with color confinement and represents a common basis for various low energy models including vector meson dominance, Goldberger-Treiman relations, πN S-wave scattering, and the broken SU(3) symmetry. It also appears to reconcile nuclear models with the finite size of the nucleon.

6927 (DOE/ER/40058—1, pp 273-288) **Status report on the NSAC Subcommittee on Electromagnetic Interactions.** Barnes, P.D. (Carnegie-Mellon Univ., Pittsburgh, PA). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

The Subcommittee has formulated its view of the physics program to be pursued in the coming years together with an analysis of the facility parameters that will be required in order to execute the highest priority components of this program. The Subcommittee foresees the opening of a new frontier for the investigation of nuclear phenomena in the momentum transfer range $q = 5$ to 15 fm^{-1} and electron energy range up to 4 GeV. Because of the opportunities they offer for fundamental advances using electromagnetic probes, the Subcommittee assigned the highest scientific priority to investigation of hadron structure and two body interactions, three and four body systems, and fundamental symmetries. This is both because of their intrinsic scientific interest and because of the opportunity they offer to study the largely unexplored transition between nucleon-meson and the quark-gluon descriptions of nuclear systems. The Subcommittee strongly recommends the construction of a variable energy electron beam facility capable of operation at both high intensity and high duty factor, and able to achieve an electron energy of about 4 GeV, for the purpose of making coincidence measurements on nuclear targets at large excitation energy and momentum transfer.

6928 (DOE/ER/40058—1, pp 462-487) **Δ-isobars in nuclear physics.** Wallace, S.J. (National Bureau of Standards, Washington, DC). 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

The role of Δ-isobars in nuclear physics is reviewed from the viewpoint of a consistent coupled-channel theory. Recent developments in the nucleon-nucleon interaction suggest a unified treatment in the energy range 0 to $\approx$ 1 GeV is possible provided that real Δ-isobar production processes are made explicit. The coupled-channel framework naturally lends itself to showing relationships between processes which are probed in nuclear scattering of pions, protons and electrons. Some anomalies in pion-nucleus interactions are reviewed.

6929 (DOE/ER/40058—1, pp 596-600) **Collective features of the nuclear response in the spin-isospin channel.** Alberico, W.M. (CERN, Geneva, Switzerland); Ericson, M.; Molinari, A. 1983. NTIS, PC A99/MF A01. (CONF-820475—).

From Conference on new horizons on electromagnetic physics; Charlottesville, VA, USA (21 Apr 1982).

In recent years a great interest has grown on the response of nuclei to a spin-isospin sensitive probe. These excitations have shown a strongly collective character, induced by the particle-hole force acting in the spin-longitudinal and transverse channels. Moreover they are influenced by the coupling of the nucleon and the Δ isobar. We have studied the response of infinite nuclear matter through the particle-hole polarization propagator.

6930 **(INIS-mf—8235) Classical model with pionic degrees of freedom for the description of high energetic heavy ion collisions.** Kunz, J. (Giessen Univ. (Germany, F.R.). Fachbereich Physik). 12 Jan 1982. 205p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE83703925.

In this thesis the classical model is extended in order to regard the inelastic processes important in the heavy ion collisions of the considered energy range. For this a classical pion field was coupled to the nucleons via the pseudo-scalar γ_5-interactions. Nucleon and pion fields were treated in a completely relativistic way. The equations of motion were analytically studied for the one-nucleon system. From the statical solution the bare mass of the nucleon was determined, and its dependence on both parameters of this modell, the coupling constant and the cut-off momentum of the form factor, was considered. (orig./HSI).

6931 (INIS-mf—8536, pp 13) **Nuclear reactions-review.** Newton, G.W.A. (Manchester Univ. (UK). Dept. of Chemistry). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).

Published in summary form only.

6932 **(INIS-mf—8596) Generator-coordinate calculation of the potential overlap for the DWBA description of cluster transfer reactions.** Lovas, R.G.; Pal, K.F.; Nagarajan, M.A. (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete). 1983. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704614.

The transition probability for the A(a,b)B (with a=b+x) reaction is investigated theoretically as a function of internal wave functions and of the sum of internucleon forces between b and x. For a system a=b+x described by the two-cluster generator-coordinate model, two exact and two much simpler approximate procedures to evaluate the transition probability as a function of internuclear distance are given. To test the feasibility of the exact procedures and the accuracy of the approximate ones, all have been carried through for the $^7Li=\alpha+t$ system. The test shows that the exact techniques are likely to be feasible even for more complicated systems at least if symbolic computation is used, but, being very accurate, one of the simple methods is also recommendable.

6933 **(INIS-mf—8670) Transition density of charge-exchange processes.** Lovas, R.G. (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete). 1983. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700523.

The transition density between parent and analogue states is studied with special reference to its role in charge-exchange nuclear reactions. The structure of the target nucleus is described in a perturbative approach, in which the Coulomb and asymmetry potentials mix the eigenstates of a charge-independent single-particle Hamiltonian. In this model formulae are derived for the transition density, the Coulomb displacement energy and the neutron-proton den-

sity difference, and their relationship is used to estimate the transition density. This estimate shows that: the largest contribution comes from the density of the excess neutrons; the weight of the Coulomb-mixing effect is small up to excess neutron number 10, and grows rapidly beyond; the weight of the core polarization term induced by the excess neutrons is modest and is the same for all nuclei. It is indicated that the Coulomb effect may explain the departure from the Lane model of nucleon charge-exchange scattering found for heavy nuclei, whereas the core polarization may account for the observed anomalous dependence of the deg 0 pion charge-exchange cross section on the number of excess neutrons.

6934 **(INIS-mf—8671) Investigations in atomic physics by heavy ion projectiles.** Berenyi, D. (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete). 1983. 20p. (CONF-830444—4). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700525.

From International school-seminar on heavy ion physics; Alushta, USSR (14 Apr 1983).

The utilization of heavy ion reactions in atomic physics is surveyed. The basic collision mechanisms and their consequences in atomic physics are summarized. The atomic and electronic processes during and after heavy ion collisions are reviewed as functions of the projectile energy. The main detection and measuring methods are described. Reviews of new information about the structure of electronic cloud and about fundamental processes based on the analysis of heavy ion reaction data are given.

6935 (INIS-mf—8672, pp 119) **Deuteron wave functions.** Crepinsek, L. (Maribor Univ. (Yugoslavia)); Zingl, H.F.K. (Graz Univ. (Austria). Inst. fuer Theoretische Physik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6936 (INIS-mf—8672, pp 63) **Influence of non-locality in the calculation of microscopic optical potentials.** Leeb, H. (Technische Univ., Vienna (Austria). Inst. fuer Experimentelle Kernphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6937 (INIS-mf—8672, pp 103) **Off-shell effects in three-partice spin observables.** Zankel, H.; Plessas, W.; Haidenbauer, J. (Graz Univ. (Austria). Inst. fuer Theoretische Physik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6938 (INIS-mf—8672, pp 103) **Electron-deuteron observable of meson theoretical nucleon-nucleon models.** Schwarz, K.; Plessas, W.; Mathelitsch, L. (Graz Univ. (Austria). Inst. fuer Theoretische Physik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6939 (INIS-mf—8672, pp 103) **Low energy parameters in three-nucleon systems.** Mathelitsch, L.; Zankel, H. (Graz Univ. (Austria). Inst. fuer Theoretische Physik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6940 (INIS-mf—8672, pp 104) **Influence of effective nucleon-nucleon potentials in transfer reactions.** Oberhummer, H.; Leeb, H. (Technische Univ., Vienna (Austria). Inst. fuer Experimentelle Kernphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6941 (INIS-mf—8672, pp 104) **Giant resonances in highly excited rotating nuclei.** Faber, M.E. (Technische Univ., Vienna (Austria). Inst. fuer Experimentelle Kernphysik); Egido, J.L. (Universidad Autonoma de Madrid (Spain)); Ring, P. (Technische Univ. Muenchen (Germany, F.R.)). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6942 (INIS-mf—8672, pp 105) **Pr-equilibrium transfer reactions. Cross sections and polarization-asymmetry ratio.** Jasicek, H.; Markum, H.; Dorninger, C.; Leeb, H. (Technische Univ., Vienna (Austria). Inst. fuer Experimentelle Kernphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6943 (INIS-mf—8672, pp 105) **Fission probability of highly excited heavy nuclei.** Faber, M.E.; Jasicek, H.; Markum, H. (Technische Univ., Vienna (Austria). Inst. fuer Experimentelle Kernphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6944 (INIS-SU—196, pp 93-94) **Hadron radiation scattering on nuclei and Compton effect at small energy.** Starkov, N.I. (Moskovskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Fil'kov, L.V.; Tsarev, V.A. (AN SSSR, Moscow. Fizicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8105209—No.1(19)).

From All-union seminar electromagnetic interactions of hadrons in the resonance energy range; Khar'kov, Ukrainian SSR (26 May 1981).

A possibility of studying the Compton scattering on hadron at low energies by measuring the cross section of high-energy hadron radiation scattering on nuclei is discussed. It is shown that the method considered may be interesting not only in the study on the Compton scattering on non-stable hadrons but also in the case of proton and neutron it may be more preferable than photon direct scattering from the view point of the measured effect. An expression for $\gamma\pi$-scattering cross section permitting to obtain π-meson polarizability according to the experimental data on $\gamma\pi$-scattering is obtained.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 6290

6945 **(EGG-PHYS—6003-Rev.1) RAFFLE V general purpose Monte Carlo code for neutron and gamma transport. Revision 1.** Wheeler, F.J.; Easson, S.A.; Grimesey, R.A.; Wessol, D.W. (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1983. Contract AC07-76ID01570. 171p. NTIS, PC A08/MF A01. Order Number DE84003847.

The RAFFLE V general-purpose Monte Carlo code is an extensively-modified version of the original RAFFLE code developed at INEL. This document describes the RAFFLE V code, emphasizing the modifications made since prior documentation. The major modifications implemented into the RAFFLE V code are: (1) implementation of the processed ENDF-B version V neutron data and an expansion of the energy range to include above-10-MeV reactions important in fusion devices; (2) incorporation of the Combinatorial Geometry subroutines developed by the Mathematical Applications Group Incorporated (MAGI) of White Plains, New York; (3) use of the Probability Table method in the unresolved resonance energy region so that neutron transport and flux shielding can be better represented; (4) the capability to perform gamma-ray transport calculations; (5) the inclusion of flux-at-a-point detectors; (6) the option to obtain microscopic reaction rates and generalized response functions by region or point; and (7) the capa-

bility to obtain time-dependent reaction rates and fluxes for fixed-source problems with no fission.

6946 (INIS-SU—196, pp 51-52) **Relativistic electron radiation in monocrystals.** Vit'ko, V.I.; Nasonov, N.N.; Shul'ga, N.F. 1982. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8105209—No.1(19)).

From All-union seminar electromagnetic interactions of hadrons in the resonance energy range; Khar'kov, Ukrainian SSR (26 May 1981).

Radiation of relativistic electrons moving in a crystal near the crystallographical axis under the conditions of superbarrier motion is considered within the frames of classical electrodynamics. Radiation spectrum of superbarrier electrons is obtained for an averaged potential of the v(e) approximately exp(-e) chain. The maximum is shown to be observed for certain electron inlet angles relatively to the chain in the radiation spectrum. It permits to conclude that the maximum in experimentally detected spectra may be caused by superbarrier particle radiation.

6947 (INIS-SU—196) **General and nuclear physics.** (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. 107p. (In Russian). (CONF-8105209—No.1(19)). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84780041.

From All-union seminar electromagnetic interactions of hadrons in the resonance energy range; Khar'kov, Ukrainian SSR (26 May 1981).

Separate entries were made in the data base for the papers presented (WHK)

6948 (LBL—16291) **Zero-field μSR and low-temperature μ^+ diffusivity in copper.** Clawson, C.W. (Lawrence Berkeley Lab., CA (USA)). Apr 1983. Contract AC03-76SF00098. 14p. (CONF-830455—10). NTIS, PC A02/MF A01. Order Number DE84002905.

From Yamada conference on muon spin rotation and associated problems; Shimoda, Japan (18 Apr 1983).

In this paper the history of μ^+ diffusion studies in copper, with particular emphasis on the increased low-temperature diffusivity which has been known for several years now, is reviewed. The theory and practice of the zero-field μSR method, which has come into increasing favor in the study of muon diffusion and trapping in metals, is surveyed, and its application to the low-temperature copper problem is discussed. 26 references.

6949 (N—8326423) **Electrostatic shielding against cosmic radiation (current status and prospects).** Ryabova, T.Y. (Joint Publications Research Service, Arlington, VA (USA)). May 1983. 5p. NTIS, PC A07.

In USSR report: Space Biol. and Aerospace Med., Vol. 17, No. 2, Mar-Apr 1983 (JPRS-83467) p 2-6 (SEE N83-26422 15-51). Translated from Kosmich. Biol. i Aviakosmich. Med. (Moscow); 17: No. 2, 4-7(Mar-Apr 1983).

Conduction currents of the vacuum atmosphere near the spacecraft were measured in an electrostatic shielding and an electrostatic shielding module in electrostatic fields of about 10 to the 7th power Wt/m at a voltage of 3x10 to the 5th power V onboard Cosmos-605, 690, 732 and 936. The resultant conduction currents give evidence that the vacuum environment has high electroinsulation properties which contradicts the concepts derived from ground based studies. Using up to date high voltage devices, it appears possible to develop an efficient electrostatic shielding which will be of a low weight and a low power consumption.

6950 **Proton-stopping power of argon, krypton, and xenon.** McGuire, E.J. (Sandia National Laboratories, Division 1231, P.O. Box 5800, Albuquerque, New Mexico 87185). *Physical Review [Section] A: General Physics;* **28**: No. 4, 2096-2103(Oct 1983).

Parameters for the Bethe stopping-power theory for Ar, Kr, and Xe are obtained both via integration over optical oscillator strengths and from explicit plane-wave Born-approximation calculations. The former procedure produces a Bethe mean excitation energy (I) significantly lower than that measured, while the latter procedure produces I values within 10 eV of the measured values for Ar and Kr. For Xe the experimental I value lies midway between the two calculated I values. Inner-shell corrections are obtained from the explicit calculations. The K-shell corrections (C/sub K/) are a factor of 2 larger than those obtained from hydrogenic calculations. The total inner-shell correction (summation/sub n/l C/sub nl/) is in qualitative agreement for Ar, Kr, and Xe with results from a statistical model. However, the quantitative difference between the two sets of inner-shell corrections leads to significant increases in I values inferred from experimental measurements below 1 MeV proton energy.

6951 **Suprathermal electron energy deposition in plasmas with the Fokker-Planck method.** Wienke, B.R. (Computing Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Computational Physics;* **51**: No. 2, 208-260(Aug 1983).

A one-dimensional, multigroup, discrete-ordinates technique for computing electron energy deposition in plasmas is detailed. The Fokker-Planck collision operator is employed in the continuous approximation and electric fields (considered external) are included in the equation. Bremsstrahlung processes are not treated. Comparisons with analytic and Monte Carlo results are given. Fits to deposition and energy scaling are proposed and discussed for monoenergetic and Maxwellian sources in the rnge 0—150 keV, with and without uniform fields.

6952 **Time dependent linear transport II Properties of weak solutions.** Wilson, D.G. (Mathematics and Statistics Research Department, Union Carbide Corportion, Nuclear Division, P. O. Box Y, Bldg. 9704-1, Oak Ridge, Tennessee 37830). *Transport Theory and Statistical Physics;* **12**: No. 2, 157-196(Apr 1983). Contract W-7405-ENG-26.

In this paper properties of weak solutions of the time-dependent linear transport equation posed in a multidimensional rectangular parallelepiped with partially reflecting walls are established. Nonnegative constituent functions are shown to guarantee that a weak solution is nonnegative. This implies a monotnoicity principle which is established. Sufficient continuity properties of the constituent functions are shown to guarantee that a weak solution will be uniformly continuous in each of its variables independently of the others on compact subsets of the interior of its domain of definition. Continuity with respect to time follows from continuity with respect to space; but continuity with respect to velocity seems to require continuity with respect to space as a precondition.

6953 **Report on the eighth international conference on transport theory.** Zweifel, P.F. (Laboratory for Transport Theory and Mathematical Physics, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061). *Transport Theory and Statistical Physics;* **12**: No. 2, 197-224(Apr 1983). Contract AS05-80ER10711.

A summary is given of the papers presented at the eighth biennial conference on transport theory which was held March 24-24, 1983 at Virginia Tech. (AIP)

6550 Medical Physics

REFER ALSO TO CITATION(S) 6650

6954 (N—8326424) **Possible directions of refining criteria of radiation safety of spaceflights.** Kovalev, Y.Y.; Petrov, V.M.; Sakovich, V.A.; Sychkov, M.A. (Joint Publications Research Service, Arlington, VA (USA)). May 1983. 8p. NTIS, PC A07.

In USSR report: Space Biol. and Aerospace Med., Vol. 17, No. 2, Mar-Apr 1983 (JPRS-83467) p 7-14 (SEE N83-26422 15-51). Translated from Kosmich. Biol. i Aviakosmich. Med. (Moscow); 17: No. 2, 8-14(Mar-Apr 1983).

The possibility of characterizing space flight radiation safety is considered using a value which is integrated over the flight time, takes into account the radiation processes in an irradiated body and averages the probability of adverse radiobiological effects with respect to the distribution of solar proton flares of varying intensity.

The proposed characteristic is compared with the current standards with reference to a hypothetic interplanetary flight.

6560 Solid State Physics

REFER ALSO TO CITATION(S) 6798, 6806

6955 (INIS-mf—8672, pp 61) **Positron annihilation rates in metals and their dependence on lattice scattering and polarization effects.** Sormann, H.; Kindl, P.; Puff, W. (Technische Univ., Graz (Austria). Inst. fuer Kernphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6956 **(NP—4770058) Some ground state properties of the Heisenberg antiferromagnet.** Grieger, W. (Goettingen Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 30 Oct 1981. 73p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84770058.

The eigenstates of the Heisenberg antiferromagnet may be classified in an n-dimensional lattice in the same way as in one dimension. The solution of the functional equation system is not possible for n equal or larger 2. The ground state for more than four lattice points has to be calculated by iterative methods for all dimensions. In one dimension no correlation is found for the ground state of distant spins. The Heisenberg model for the antiferromagnet does not show spin alignment, thus no antiferromagnetic behavior. For higher dimensions the problem is still unsolved.

6957 **Local-field effect on linear and nonlinear optical properties of adsorbed molecules.** Ye, P.; Shen, Y.R. (Department of Physics, University of California, Berkeley, California 94720 and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review [Section] B: Condensed Matter;* **28**: No. 8, 4288-4294(15 Oct 1983). Contract AC03-76SF00098.

A classical point-dipole model is used to calculate the local-field effect on the optical properties of adsorbed molecules on a substrate. The spatially nonvarying component of the local field at the molecules can be described by using a local-field correction factor. Equally important is the spatially varying component of the local field which arises mainly from the molecule-substrate interaction. The rapid variation over the molecular dimension can appreciably modify the transition-matrix elements and break down the electric dipole selection rules. The effect becomes insignificant if the molecules are more than 2.5 A away from the substrate even in the metal case. Both components of the local field contribute to the effective linear and nonlinear polarizabilities of the adsorbed molecules. Nonlinearity due to molecular response to the harmonic frequency components of the local field discussed by Antoniewicz appears to be less important.

6958 **Recent advances in the theory of chemical diffusion in defective solids.** Murch, G.E. (Argonne National Lab., IL). *Solid State Ionics;* **6**: 295-302(1982). Contract W-31-109-ENG-38.

Recent advances in the theory of chemical diffusion in solids with high defect concentrations are reviewed and discussed with the object of establishing common ground among the various approaches. Emphasis has been placed on exact results gained from: (1) phenomenological models of chemical diffusion including ambipolar diffusion; and (2) atomistic models including lattice gas models.

6561 Superconductivity

REFER ALSO TO CITATION(S) 6171, 6172, 6178, 6184, 6185, 6230, 6235

6570 Theoretical Physics

REFER ALSO TO CITATION(S) 6806, 6877, 6957

6959 (INIS-mf—8672, pp 20) **Recent developments in the physics of high energy atom collisions.** Lutz, H.O. (Bielefeld Univ. (Germany, F.R.). Fakultaet fuer Physik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6960 **(INIS-mf—8683) Kinetic theory of transport processes in partially ionized gases.** Odenhoven, F.J.F. van. (Technische Hogeschool Eindhoven (Netherlands)). 18 Feb 1983. 162p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE84700517.

The work presented in this thesis shows that a perturbation expansion in the framework of the multiple time scale formalism is well suited to attack the complicated set of kinetic equations describing transport phenomena in a partially ionized gas. The equations are limited to elastic collision processes only. The aim of the present work is to describe transport phenomena at thermal energies and to calculate transport coefficients. As partially ionized gases are in general low temperature plasmas of thermal energies well below the first excitation level the restriction above is not unrealistic. In chapter II the basic considerations are given. In chapter III the necessity of a first order isotropic correction in a very weakly ionized gas, when only electron-atom collisions are taken into account, is proved for a situation with the same ordering of parameters as that of Bernstein. Also for a weakly ionized gas, as studied in chapter IV, an isotropic correction has to be introduced. The integro-differential equation for it is solved analytically. Chapter V deals with the strongly ionized domain. The equation for the first order non-isotropic part of the electron distribution function has been cast in the form of a fourth order differential equation. The results of the numerical calculations in realistic cases are collected in chapter VI.

6961 **(INIS-SU—184) Microcalorimetric methods in low-temperature physics. Review.** Tanko, L.; Shikov, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. 40p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704610.

A review presents current methods of microcalorimetry (except for differential ones) used in low-temperature physics. A criterion is indicated for useful application of microcalorimetric techniques, and a brief chronology of works is given on elaboration and application of low-temperature methods in experimental physics. The basic microcalorimetric methods are outlined that are employed in the low temperature range (0.05-300 K): the AC-method, relaxation method, method of continuous heating (cooling down), diffusion method (method of temperature waves), and iterative method. A more detailed methematical analysis is given for the last three methods. The advantages and shortcomings of each method are considered. The spheres of application are indicated. The design features of microcalorimeters are given a special attention. Various microcalorimetric methods are compared, and conditions are indicated for realising a 1% accuracy of the heat capacity measurement. The trends of low-temperature microcalorimetry evolution are discussed, as well as other problems that are to be solved.

6962 **(SAND—83-7134) User's manual for CONTA: program for calculating surface heat fluxes from transient temperatures inside solids.** Beck, J.V. (Michigan State Univ., East Lansing (USA)). Dec 1983. Contract AC04-76DP00789. 89p. NTIS, PC A05/MF A01. Order Number DE84004854.

This report is a user's manual for program CONTA. This program provides a means for the numerical solution of the nonlinear, one-dimensional planar, inverse heat conduction problem (IHCP). The IHCP is the problem of estimating the surface heat flux history utilizing measured transient interior temperatures. The surface temperature is also estimated. Up to four measured temperature histories can be used; they can be any location in the body and are given at uniformly-spaced discrete times. The basic equations are given in differential form and also in the finite difference form that is used in the program. The numerical inverse heat conduction algorithm is given in detail. The program is described and detailed instructions are given regarding the input. Two test cases are given to illustrate the input and the output. These test cases also provide insight into the engineering use of the program. A discussion is given of the selection of certain critical input quantities. Methods of investigating the accuracy of calculations are also included. The use of CONTA for calculating heat transfer coefficients is discussed.

6963 **Dispersion of extensional waves in fluid-saturated porous cylinders at ultrasonic frequencies.** Berryman, J.G. (Lawrence Livermore National Laboratory, P. O. Box. 808, L-200, Livermore, California 94550). *Journal of the Acoustical Society of America;* **74**: No. 6, 1805-1812(Dec 1983).

Ultrasonic dispersion of extensional waves in fluid-saturated porous cylinders is studied by analyzing generalized Pochhammer equations derived using Biot's theory. Cases with open-pore surface and closed-pore surface boundary conditions are considered. For both cases, the dispersion of the fast extensional wave does not differ much qualitatively from the dispersion expected for extensional waves in isotropic elastic cylinders. A slow extensional wave propagates in the case with a closed-pore surface but not in the case with an open-pore surface. The propagating slow wave has very weak dispersion and its speed is always lower than, but close to, the bulk slow wave speed.

6964 **Elastic wave scattering from irregular voids.** Tittmann, B.R.; Domany, E.; Opsal, J.L.; Newman, K.E. (Rockwell International Science Center, Thousand Oaks, California 91360). *Journal of Applied Physics;* **54**: No. 11, 6079-6085(Nov 1983).

Results are presented for elastic wave scattering from irregular voids embedded in Ti alloy by the diffusion bonding process. The defects examined are: two overlapping spherical voids of unequal radii, two overlapping voids consisting of a sphere and a prolate spheroid, and a spherical void with an encircling crack. Representative plots are given for the raw waveforms, magnitude of the deconvolved Fourier transform, and in some cases the time impulse response function. The data are compared to and analyzed in terms of two current theoretical approaches. While good quantitative agreement was observed over certain ranges, the comparisons point to definite (in some cases not unexpected) limitations in either the pertaining theory or experiment or both. The results are discussed with an eye toward applications to nondestructive evaluation.

6965 **Pairs of two-level systems.** Fano, U. (Department of Physics, University of Chicago, Chicago, Illinois 60637). *Reviews of Modern Physics;* **55**: No. 4, 855-874(Oct 1983).

Correlations between the orientations of two particles with spin 1/2 are formulated in terms of a complete set of operators appropriate to display the spectrum of oscillations under the influence of the spin interactions. The operators are classified for this purpose according to space and permutation symmetries. The treatment is intended as a model for any pair of two-level systems. Its extension to multilevel systems and the eventual emergence of dissipative behavior are outlined. The correlation of two-photon polarizations in the Einstein-Rosen-Podolsky paradox is described as an illustration.

6966 **Simulation of quantum systems with random walks: A new algorithm for charged systems.** Ceperley, D. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Journal of Computational Physics;* **51**: No. 3, 404-483(Sep 1983). Contract W-7405-ENG-48.

Random walks with branching have been used to calculate exact properties of the ground state of quantum many-body systems. In this paper, a more general Green's function identity is derived which relates the potential energy, a trial wavefunction, and a trial density matrix to the rules of a branched random walk. It is shown that an efficient algorithm requires a good trial wavefunction, a good trial density matrix, and a good sampling of this density matrix. An accurate density matrix is constructed for Coulomb systems using the path integral formula. The random walks from this new algorithm diffuse through phase space an order of magnitude faster than the previous Green's Function Monte Carlo method. In contrast to the simple diffusion Monte Carlo algorithm, it is exact method. Representative results are presented for several molecules.

6967 **Quasi-regular singularities in general relativity.** Vickers, J.A.G. York, England; York University (1980). 212p. British Library, Boston Spa, Wetherby, West Yorks. No. D37596/81.

Thesis.

Two s-holonomy groups are defined and used to investigate the structure of quasi-regular singularities in general relativity. A definition of stability of quasi-regular singularities is given and it is shown that 'cone-like' singularities are unstable in this sense. The geometry of two-dimensional quasi-regular singularities is examined and it is shown that 'cone-like' singularities provide a good model for such singularities. It is thus demonstrated that a general time-like quasi-regular singularity is expected to be unstable.

6968 **Complementarity: a study of Bohr's philosophy of quantum physics.** Murdoch, D.R. Oxford, England; Oxford University (1980). 326p. British Library, Boston Spa, Wetherby, West Yorks. No. D37398/81.

Thesis.

A comprehensive interpretation is given of Bohr's philosophy of quantum physics based upon a close examination of his writings. Extensive use is made of unpublished documents in the Niels Bohr Archive. The evolution of Bohr's attempts to resolve the paradox of wave-particle duality, which culminated in his thesis of complementarity in 1927, is reconstructed from published and unpublished sources. The meaning and significance of the complementarity thesis is examined in the light of the detailed arguments which Bohr proposed to support it. Two main sorts of complementarity are distinguished: wave-particle complementarity, and position-momentum complementarity. Bohr's theory of measurement is reconstructed and compared with some formal theories, none of which is found to represent Bohr's theory adequately.

6580 Mathematical Physics

REFER ALSO TO CITATION(S) 6789, 6800

6969 **(DOE/ER/03077—203) Accuracy of stable schemes for 2D scalar conservation laws.** Goodman, J.B.; LeVeque, R.J. (New York Univ., NY (USA). Courant Mathematics and Computing Lab.). Nov 1983. Contract AC02-76ER03077. 17p. NTIS, PC A02/MF A01. Order Number DE84004989.

We show that any conservation scheme for solving scalar conservation laws in two space dimensions which is total variation diminishing is at most first order accurate.

6970 **(SAND—83-1927) Efficient extrapolation methods for ODEs, II.** Shampine, L.F. (Sandia National Labs., Livermore, CA (USA)). Sep 1983. Contract AC04-76DP00789. 13p. NTIS, PC A02/MF A01. Order Number DE84003332.

Extrapolation methods for the solution of the initial value problem for a system of ordinary differential equations (ODEs) advance the integration one step by combining the results of a number of subintegrations carried out with a simple method and fixed step size. The choice of step size in the subintegrations influences the efficiency of the resulting formula. In a first investigation it was shown how to quantify this influence. Here this influence is studied when the code is attempting to select the optimal order at each step. A novel result about this optimal order allows the two most important experimental developments to be fully explained.

6971 **Das Lee-Modell in der expS-Theorie. (Lee model in the expS theory).** Bodden, P. Bochum, Germany, F.R.; Bochum Universitaet (1981). 142p. (In German). Library of Bochum Univ. (Germany, F.R.).

Thesis.

The present thesis is concerned with the study of the Lee model in the many-body sector. In the framework of the expS theory by a suitable definition of the correlation amplitudes a hierarchy of coupled integral equations could be derived. The two-body equation can by analytically solved after performed solution of the one-body equation. By this one- and two-body equations can be combined to a nonlinear integral equation which can then, for instance, be iteratively solved. After performed solution of this equation the binding energy of the density was then studied in dependence of the density. The variation of the coupling constant showed an essentially move sensitive reaction. Already at a value below of about 13 no bound state exists. Finally the cut-off parameter of the interaction was varied. Summarizingly it can be said that the question of the renormalizability of many-body systems could be at least in the Lee model in a sufficient way be answered. Also a formalism could be developed which is independent of the special symmetry of the Lee model and can therefore also be applied to more realistic models.

70 FUSION ENERGY

7001 Plasma Research

REFER ALSO TO CITATION(S) 7055

6972 (CONF-830758—, pp 55-66) **ELMO bumpy square.** Owen, L.W.; Lee, D.K.; Hedrick, C.L. Jr. (Oak Ridge National Lab., TN). Oct 1983. NTIS, PC A19/MF A01. Contract W-7405-ENG-26.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

New magnetics configurations based on the ELMO Bumpy Torus (EBT) confinement concept have been developed. The ELMO Bumpy Racetrack, Triangle or Square is formed by two, three, or four linear arrays of magnetic mirrors linked by sections of a high field toroidal solenoid. (The focus of this work is on the ELMO Bumpy Square (EBS).) These configurations localize the unavoidable toroidal curvature in regions in which the magnetic field is much stronger than the average field in the mirror sections, and thereby minimize its effect on single particle drift orbits, plasma volume utilization, etc. As in EBT, the central core plasma is stabilized by the presence of hot electron rings in the mirror cavities. High field solenoid sections (corner of the square in EBS) of circular and elliptical cross section have been analyzed. The elliptical shape is found to give the best passing particle confinement. Single particle drift orbits, the radial position of the minimum of the longitudinal invariant J, and a crude measure of the diffusion step size for particles near the hot electron rings are presented for EBS and compared to those for EBT-I/S.

6973 (CONF-830758—, pp 71) **Orbits aspect of advanced bumpy torus.** Kamimura, T.; Fujiwara, M.; Ikegami, H. (Nagoya Univ., Japan). Oct 1983. NTIS, PC A19/MF A01.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

6974 (CONF-830758—, pp 167-176) **Energetic particles in tokamaks: stabilization of ballooning modes.** Van Dam, J.W. (McDonnell-Douglas Astronautics Co., St. Louis, MO); Rosenbluth, M.N.; Tsai, S.T.; Engquist, M.G. Oct 1983. NTIS, PC A19/MF A01.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

The introduction of an ELMO-type superhot particle species trapped in the unfavorable curvature region of a tokamak has recently been shown to provide the possibility of stable access to high-beta confinement. The energetic particles stabilize high-mode-number ballooning modes up into the regime of second stability, after which they are no longer required. A summary is given of stability estimates calculated for a model shifted-circle, large-aspect-ratio equilibrium.

6975 (CONF-830758—, pp 191-216) **Nonresonant particle transport for bumpy field line devices with arbitrary shaped flux surfaces.** Hastings, D.E. (Oak Ridge National Lab., TN). Oct 1983. NTIS, PC A19/MF A01. Contract W-7405-ENG-26.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

In a bumpy closed field line device, the radial drift through the pressure surfaces is the sum of the del B, curvature, and poloidal electric field drifts. Since the del B and curvature drifts are determined by the magnetic field geometry, which for low beta plasmas are independent of the plasma, the radial drift is a function of plasma position. This may enhance the vertical drift that a particle sees and hence neoclassical diffusion. Another way the vertical drift may be enhanced is if the magnetic field has a poloidal structure beyond that caused by the toroidal effects (e.g., if the mod-B surfaces are slightly elliptical in shape). We shall explore the changes in the diffusion coefficients caused by both of these effects.

6976 (CONF-830758—, pp 219-236) **Wave interactions with EBT plasmas in the magnetic drift frequency range.** McBride, J.B. (Science Applications, Inc., La Jolla, CA); Rosenberg, M.; Krall, N.A. Oct 1983. NTIS, PC A19/MF A01. Contract AC01-82ER53126.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

We calculate the particle and energy transport and heating that results from the resonant, quasilinear interaction of EBT plasma particles with waves in the magnetic drift frequency range. Substantial transport can occur even for relatively small wave field amplitudes. For example, for flute perturbations of relative amplitude δB/B, the wave induced diffusion can exceed neoclassical diffusion in the collisionless regime for δB/B ~ (nu/ωdel)/sup 1/2/ A^{-1}, where A^{-1} is the inverse aspect ratio and nu, ωdel are the collision and thermal grad B drift frequencies, respectively. The diffusion is selective and can cause preferential transport of a single sign of charge or energy component. Possible applications include plasma pressure and ambipolar potential profile modification, instability induced transport arising from curvature or drift modes and α-ash removal. In addition, this type of wave-particle interaction may play a role in the observed changes in EBT-S electron ring parameters during ICH experiments.

6977 (CONF-830758—, pp 237-260) **Stability bounds for ballooning modes in EBT.** Nguyen, K.; Kammash, T. (Univ. of Michigan, Ann Arbor). Oct 1983. NTIS, PC A19/MF A01.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

Most recent studies of EBT stability have produced beta values based on the stability of the interchange mode in which variations of the field curvature along the field are ignored. In this paper we examine the macroscopic stability of an EBT plasma in a slab model taking into account variations of the curvature along the field. A quasi-kinetic aproach is followed in which the interaction of the hot electron component with the plasma as well as the finite Larmor radius (FLR) effects of the background ions are included. It is shown that in the absence of FLR a critical hot electron beta must be achieved in order for the ballooning modes to be stable and that this threshold value agrees very well with an MHD rigid ring result deduced by an energy principle. The analysis also shows that when the compression term has a pole inside the ring the background ballooning mode becomes stable for any value of the hot electron beta due to strong line tying which would not arise if the hot electrons were not allowed to be perturbed. Finally it is shown that the upper bound on the core beta is in agreement with the Van Dam and Lee limit if the radius of curvature at the midplane rather than the average curvature is used in the local stability analysis.

6978 (CONF-830758—, pp 261-270) **Effects of ambipolar field on low frequency fluctuations in bumpy tori.** Sanuki, H. (Univ. of California, Los Angeles). Oct 1983. NTIS, PC A19/MF A01.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

Nonlocal properties of electrostatic drift waves in a straight magnetic field in a collisionless and low-β plasma with a hot electron component are discussed analytically in detail. Interesting drift wave features such as eigenfrequency, growth rate, radial wavenumber, and position of localization are clarified. Effects of the ambipolar potential on the stability of drift waves are also studied and related to low frequency fluctuations measured in EBT/NBT experiments. It is found that a strong ambipolar field has a stabilizing influence on unstable drift waves.

6979 (CONF-830758—, pp 273-284) **Plasma confinement in self-consistent, one-dimensional transport equilibria in the collisionless-ion regime of EBT operation.** Chang, C.S.; Miller, R.L. (AMPC Inc., Encinitas, CA). Oct 1983. NTIS, PC A19/MF A01. Contract AC03-82ER51030.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

It has long been recognized that if an EBT-confined plasma could be maintained in the collisionless-ion regime, characterized by positive ambipolar potential and positive radial electric field, the particle loss rates could be reduced by a large factor. The extent to which the loss rate of energy could be reduced has not been as clearly determined, and has been investigated recently using a one-dimensional, time-dependent transport code developed for this purpose. We find that the energy confinement can be improved by roughly an order of magnitude by maintaining a positive radial electric field that increases monotonically with radius, giving a large ExB drift near the outer edge of the core plasma. The radial profiles of heat deposition required to sustain these equilibria will be presented, and scenarios for obtaining dynamical access to the equilibria will be discussed.

6980 (CONF-830758—, pp 285-317) **ICRF confinement and stabilization of torus plasma. Part I. Theoretical analysis.** Hojo, H.; Hamamatsu, K.; Watanabe, T.; Nishikawa, K. (Hiroshima Univ., Japan). Oct 1983. NTIS, PC A19/MF A01.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

Possibility for improving confinement and MHD stability of torus plasma by the ponderomotive force of rf field in the ion cyclotron range of frequencies is studied. The ponderomotive force perpendicular to the magnetic field produces cross-field drift in addition to the curvature and gradient-B drifts. As a result, closed particle drift orbits can be formed. Numerical calculation of particle orbits in a simple torus with strong rf field is carried out to show the ICRF confinement of plasma. Vlasov equilibrium of torus plasma with rf field is also studied for a simplified model. When the drift due to the ponderomotive force perpendicular to the magnetic field cancels the curvature drift, the MHD instability such as curvature-driven interchange modes can be suppressed. ICRF stabilization of a hot electron plasma due to the pondeomotive force effect is studied theoretically. A particle simulation is carried out for a gravity-driven mode analogous to the interchange mode and the stabilization by ponderomotive force of ICRF field is shown.

6981 (CONF-830758—, pp 318-326) **Particle simulations of rf stabilization of the flute instabilities. Part II. Particle simulation.** Sakai, K.; Takeuchi, S.; Matsumoto, M. (Yamanashi Univ., Kofu, Japan). Oct 1983. NTIS, PC A19/MF A01.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

A 2-1/2 dimensional fully electromagnetic particle code used to study RF stabilization of the flute instabilities. It is graphically shown that a suitably applied Rf electromagnetic field of a frequency $\omega > \omega$/sub ci/ effectively stabilizes a flute instability, where ω/sub ci/ is the ion cyclotron frequency.

6982 (CONF-830758—, pp 327-362) **Electric field bumpy torus (EFBT) concept: an alternate means of plasma production.** Roth, J.R. (Univ. of Tennessee, Knoxville). Oct 1983. NTIS, PC A19/MF A01.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

It is very probable that the EBT approach to plasma confinement and heating in a bumpy torus geometry has gone as far as it can with the existing mechanism for plasma production. If the average plasma number density could be increased by a factor of 2 to 4 above the 10^{12}/cm^3 recently reported for the EBT-S experiment, this would allow greatly increased coupling and absorption of ICRH power to the toroidal plasma; a factor of 5 to 10 increase in number density above EBT-S levels would reach the burnout regime, in which the neutral mean free paths are smaller than the plasma radius. In the burnout regime, the interpretation of physical processes in the plasma would be greatly simplified, and the energy balance of the toroidal plasma would no longer be charge-exchange dominated. The Electric Field Bumpy Torus (EFBT) approach has demonstrated the production of a steady-state plasma in a bumpy toroidal magnetic field with average number densities up to 3.2 x 10^{12}/cm^3 and maximum number densities greater than 6 x 10^{12}/cm^3 on the plasma axis. These number densities should be sufficient to increase the coupling of ICRH power above levels characteristic of the EBT-S experiment. Simple modifications of the EFBT approach should allow the higher densities required for plasma burnout to be achieved.

6983 (CONF-830758—, pp 365-384) **Buildup and sustainment of 10^{13} cm^{-3} plasma by ICRF in RFC-XX.** Sato, T. (Nagoya Univ., Japan); Okamura, S.; Adati, K.; Aoki, T.; Baker, D.R.; Fujita, H.; Garner, H.R.; Hattori, K.; Hidekuma, S.; Kawamoto, T. Oct 1983. NTIS, PC A19/MF A01.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

A high density plasma is produced in the central section of RFC-XX by rf fields in the ion cyclotron frequency range. The magnetic field configuration of the central section is a solenoid or a mirror. An externally injected plasma or an ECH produced plasma is used as a start-up plasma. RF fields are applied to this plasma by a rotating type-III antenna to build up a high density plasma and to sustain it. The rotating type-III antenna can excite the left-hand circularly (m=-1), the right-hand circularly (m=+1), or the linearly (m=+-1) polarized wave. In general, the m=+1 excitation can produce higher density (up to 7 x 10^{13} cm^{-3}) and rather low ion temperature (30 to 50 eV) plasmas, and the m=-1 excitation can produce higher ion temperature (100 to 150 eV) and moderate density ($\sim 10^{13}$ cm^{-3}) plasmas. The plasma is sustained for the duration of the rf pulse and gas puffing ($\sim$ 50 ms). This method is applicable to various kinds of magnetic fusion experimental devices.

6984 (CONF-830758—, pp 385-394) **EBT microwave deposition modeling.** Tamor, S. (Science Applications, Inc., La Jolla, CA). Oct 1983. NTIS, PC A19/MF A01. Contract AC01-82ER53126.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

In view of the great importance of energy deposition calculations in evaluation of EBT performance, an investigation of such models is underway to determine the sensitivity of their predictions to details of the model and to plasma parameters. A multi-region model has been formulated which is similar to, but not identical with, that proposed by Batchelor. The model can be used to simulate both start-up and steady state conditions. The most interesting result thus far obtained is the great sensitivity of the energy coupled to the plasma to assumed wall reflection conditions. The model is presented in some detail, and numerical results ar discussed.

6985 **(CONF-831011—4) Velocity and electronic state distributions of sputtered Fe atoms by laser-induced fluorescence spectroscopy.** Young, C.E.; Calaway, W.F.; Pellin, M.J.; Gruen, D.M. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 21p. NTIS, PC A02/MF A01. Order Number DE84003649.

From American Vacuum Society symposium; Boston, MA, USA (31 Oct 1983).

Velocity distributions and relative populations in the fine-structure levels of the a^{5}D/sub J/ ground state of Fe atoms, produced by sputtering with 3 keV argon ions, have been investigated by Doppler shifted laser induced fluorescence. The laser system

employs a single-mode, scanning ring dye laser, amplified by a sequence of three excimer-pumped flowing-dye cells. Frequency doubling in a KD*P crystal was used to produce high energy (> .5 mJ) pulses of narrowband tunable UV output near 300 nm. Laser power influence on effective velocity bandwidth was investigated. Favorable light-collection geometry minimized distortion of the velocity spectra from apparatus-averaging effects. In impurity flux diagnostic applications in fusion devices, substantial spatial averaging may occur. In the latter case, the narrow velocity bandwidth (70 m/s, transform limit) of the present laser system is particularly useful.

6986 **(DOE/ET/53023—T1) Experiment to measure low frequency plasma fluctuations by large aperture homodyne methods.** Angel, T.R. (California Univ., San Diego, La Jolla (USA). Dept. of Physics). 1980. Contract AT03-76ET53023. 148p. NTIS, PC A07/MF A01. Order Number DE83011508.

Thesis.

Small amplitude plasma density fluctuations contribute to the large scale particle and energy transport observed in tokamak plasmas. The low frequency drift waves, propagating nearly perpendicular to the toroidal magnetic field, are among the largest of these plasma density fluctuations. Any information on the characteristics of these waves will be used to evaluate theoretical models of the plasma loss mechanism. In order to measure these waves, a forward scattering system has been constructed and assembled on the UCLA Microtor. A non-flow low pressure 10 kilowatt half millisecond pulse carbon dioxide laser was designed and constructed for this experiment. Using only mirrors to profile the laser output beam, a large aperture portion was passed (up and down) through the minor cross-section of the plasma.

6987 **(DOE/ET/53051—60) Experimental study of high beta toroidal plasmas.** Kellman, A.G. (Wisconsin Univ., Madison (USA). Dept. of Physics). Sep 1983. Contract AC02-76ET53051. 119p. NTIS, PC A06/MF A01. Order Number DE84004869.

Portions are illegible in microfiche products. Original copy available until stock is exhausted; Thesis.

Experiments on the Wisconsin Levitated Toroidal Octupole have produced a wide range of stable high β plasmas with β significantly above single fluid MHD theory predictions. A stable $\beta \sim 8\%$ plasma, twice the fluid limit, is obtained with 5 rho/sub i/ $\sim$ L/sub n/ and tau/sub β/ $\cong$ 6000 tau/sub Alfven/ = 600 μsec. The enhanced stability is explained with a kinetic treatment that includes the effect of finite ion gyroradius which couples the ballooning mode to an ion drift wave. In a more collisional, large gyroradius (2 rho/sub i/ $\sim$ L/sub n/) regime, a stable $\beta \sim 35\%$ plasma is obtained with a decay time of 1000 Alfven times. Measurement of the equilibrium magnetic field in this regime indicates that the diamagnetic current density is five times smaller than predicted by ideal MHD, probably due to ion gyroviscosity. Particle transport is anomalous and ranges from agreement with the classical diffusion rate at the highest beta, lowest field plasma (B/sub P/ = 200 G), to thirteen times the classical rate in a β=11%, high field plasma (B/sub P/ = 860 G) where the level of enhancement increase with magnetic field. Fluctuations in density, electrostatic potential, and magnetic field have been studied in plasmas with β from 0.1% to 40%.

6988 **(GA-A—17178) Power flow in neutral beam-heated limiter discharges in the D-III tokamak.** Petrie, T.W.; Armentrout, C.; Burrell, K.H.; Hino, T.; Kahn, C.; Kim, J.; Lohr, J.; Schissel, D.P. (GA Technologies, Inc., San Diego, CA (USA)). Jul 1983. Contract AT03-76ET51011. 23p. (CONF-830795—5). NTIS, PC A02/MF A01. Order Number DE84003811.

From Symposium on energy removal and particle control and toroidal fusion devices; Princeton, NJ, USA (26 Jul 1983).

Bolometric, thermocouple, Langmuir probe and infrared camera data are used to deduce the power flow in neutral beam-heated (P/sub input/$\leqq$ 5 MW), dee-shaped, limiter discharges. Power loss measurements typically account for $\leqq$ 60% of the total input power, with the majority either deposited on the primary limiter (20 to 40%) or radiated away (10 to 25%). Infrared camera measurements indicate that the heat flux to the ion drift side of the primary limiter is significantly greater than that to the electron drift side. Charge exchange neutral analysis, diamagnetic loop data and photodiode observations are consistent with a non-thermal flux of fast, beam produced particles to the limiter. If such an effect is indeed present, it could be partially responsible for the degradation in energy confinement observed during beam heating. Analysis of data comparing neutral beam injection from the two beamlines indicates that there is a variance in the energy confinement time which is beamline specific; this variance may be correlated to the limiter location relative to the beamlines.

6989 (INIS-mf—8672, pp 62) **Influence of nuclear elastic scattering on the transport of energetic ions in plasmas.** Kamelander, G. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Reaktorsicherheit). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6990 (INIS-mf—8672, pp 100) **Muon-catalysed fusion in deuterium-tritium mixtures.** Breunlich, W.H.; Cargnelli, M.; Fuhrmann, H.; Kammel, P.; Marton, J.; Pawlek, P.; Werner, J.; Zmeskal, J. (Oesterreichische Akademie der Wissenschaften, Vienna). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

6991 **(PPPL—2045) Survey of atomic processes in edge plasmas.** Janev, R.K.; Post, D.E.; Langer, W.D.; Evans, K.; Heifetz, D.B.; Weisheit, J.C. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Nov 1983. Contract AC02-76CH03073. 22p. NTIS, PC A02/MF A01. Order Number DE84003466.

A review of the most important reactions of atomic and molecular hydrogen with the fusion edge plasma electrons and ions is presented. An appropriate characterization of the considered collision processes, useful in plasma edge studies (evaluated cross sections, reaction rates, energy gain/loss per collision, etc.) has been performed. While a complete survey of atomic physics of fusion edge plasmas will be given elsewhere shortly, we demonstrate here the relevance of the atomic collision processes for describing the physical state of edge plasmas and understanding the energy balance in cool divertor plasmas. It is found that the excited neutral species play an important role in the low-temperature, high-density plasmas.

6992 **(PPPL—2050) Mode conversion and electron heating near the upper hybrid resonance frequency.** Smith, B.L.; Okuda, H.; Abe, H. (Princeton Univ., NJ (USA). Plasma Physics Lab.; Kyoto Univ. (Japan). Dept. of Electronics). Nov 1983. Contract AC02-76CH03073. 33p. NTIS, PC A03/ MF A01. Order Number DE84003465.

Mode conversion near the upper hybrid resonance frequency and electron heating are studied using a one-dimensional electromagnetic relativistic particle code. It is found that for a sufficiently small pump field E_0, $E_0^2/4\pi nT$/sub e/ $\leqq$ 0.01, electron heating is localized in a region near the electron cyclotron layer where the pump frequency is equal to the local electron gyrofrequency. For stronger pump fields, electron heating takes place more or less uniformly across a region between the upper hybrid resonance layer and the cyclotron layer. In addition, a significant fraction of electromagnetic energy associated with the pump is found to be reflected back into the vacuum from a region in the plasma near the upper hybrid resonance layer for both strong ($E_0^2/4\pi nT$/sub e/ $\cong$ 1) and weak pumps ($E_0^2/4\pi nT$/sub e/ $<<$ 1).

6993 **(PPPL—2058) Effects of ion cyclotron harmonic damping on current drive in the lower hybrid frequency range.** Wong, K.L.; Ono, M. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Nov 1983. Contract AC02-76CH03073. 31p. NTIS, PC A03/MF A01. Order Number DE84003464.

We investigate the ion cyclotron harmonic damping effects on slow and fast waves in the lower hybrid frequency range for to-

kamak reactor parameters. Inclusion of the higher order terms in the hot plasma dielectric tensor introduces ion cyclotron harmonic damping; these terms also contribute to the real part of the dispersion relation and affect the wave trajectories. However, wave absorption by 15 keV deuterium and tritium ions can be avoided by choosing the slow wave frequency above the lower hybrid frequency and the fast wave frequency below the lower hybrid frequency. But preliminary estimates show that energetic alpha particles tend to absorb both the slow and the fast waves. This absorption may become a serious obstacle for fusion-reactor current drive in the lower hybrid frequency range.

6994 **(UCRL—89236) Polarizing holographic reflector for electron cyclotron resonant heating (ECRH) on the Tandem Mirror Experiment Upgrade (TMX-U).** Coffield, F.E.; Felker, B.; Gallagher, N.C. Jr.; Pedrotti, L.R.; Stallard, B.W.; Sweeney, D.W.; Wyman, E.W.; Christensen, T.E. (Lawrence Livermore National Lab., CA (USA); TRW, Inc., Redondo Beach, CA (USA)). 14 Nov 1983. Contract W-7405-ENG-48. 6p. (CONF-831203—20). NTIS, PC A02/MF A01. Order Number DE84003740.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

A reflector for electron cyclotron resonant heating on the Tandem Mirror Experiment Upgrade has been designed to convert the high-power TE_{01} output of the circular waveguide system into a linearly polarized gaussian intensity pattern in the plasma. The reflector is a computer-generated holographic optical element with a twist polarizer. Its design, fabrication, and performance are discussed. Results of the low- and high-power tests are presented. Low-power tests were used to determine the beam pattern and the degree of cross-polarization. High-power tests verified that arcing across the grooves of the twist polarizer does not occur.

6995 **(UCRL—89244) Microwave interferometer using 94-GHz solid-state sources.** Coffield, F.E.; Thomas, S.R.; Lang, D.D.; Stever, R.D. (Lawrence Livermore National Lab., CA (USA)). 14 Nov 1983. Contract W-7405-ENG-48. 6p. (CONF-831203—29). NTIS, PC A02/MF A01. Order Number DE84003741.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

A 94-GHz microwave interferometer has been designed for the Tandem Mirror Experiment Upgrade and the Mirror Fusion Test Facility to replace the 140-GHz system. The new system is smaller and has modular single-channel units designed for high reliability. It is magnetically shielded and can be mounted close to the machine, which allows the use of lower power solid-state sources. Test results of the 94-GHz prototype indicate that the phase resolution is better than 1^{0}, the Impatt FM noise is 5 MHz wide, and the Gunn FM noise is 6 kHz wide. This paper presents the antenna designs along with the test results and discusses the unique problems associated with diagnosing a high electron temperature plasma in the presence of electron cyclotron resonant heating.

6996 **(UCRL—89246) Development of procedures to ensure quality and integrity in Tandem Mirror Experiment-Upgrade (TMX-U) diagnostics systems.** Coutts, G.W.; Coon, M.L.; Hinz, A.F.; Hornady, R.S.; Lang, D.D.; Lund, N.P. (Lawrence Livermore National Lab., CA (USA)). 30 Nov 1983. Contract W-7405-ENG-48. 6p. (CONF-831203—23). NTIS, PC A02/MF A01. Order Number DE84003753.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The diagnostic systems for Tandem Mirror Experiment-Upgrade (TMX-U) have grown from eleven initial systems to more than twenty systems. During operation, diagnostic system modifications are sometimes required to complete experimental objectives. Also, during operations new diagnostic systems are being developed and implemented. To ensure and maintain the quality and integrity of the data signals, a set of plans and systematic actions are being developed. This paper reviews the procedures set in place to maintain the integrity of existing data systems and ensure the performance objectives of new diagnostics being added.

6997 **(UCRL—89272) Status of the Tandem Mirror Experiment-Upgrade (TMX-U) diagnostic system.** Coutts, G.W.; Coffield, F.E.; Hornady, R.S. (Lawrence Livermore National Lab., CA (USA)). 26 Nov 1983. Contract W-7405-ENG-48. 8p. (CONF-831203—17). NTIS, PC A02/MF A01. Order Number DE84003742.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

This paper presents the current status of the Tandem Mirror Experiment-Upgrade (TMX-U) diagnostics system. For the initial instruments active on TMX-U, the expansions or upgrades that have been implemented are outlined. For the newly added systems, more implementation details are presented.

6998 **Laue diffraction hard x-ray spectrometer for laser fusion diagnostics.** Priedhorsky, W.C.; Lier, D.W.; Day, R.H. (University of California, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Review of Scientific Instruments;* **54**: No. 12, 1605-1610(Dec 1983).

We show that a crystal spectrometer used in the Laue mode is a useful diagnostic of high-energy x-ray emission from laser fusion plasmas. It has good collection efficiency and adequate energy resolution for continuum measurements. The instrument measures time integrated x-ray spectra with a resolving power $E/\Delta E$roughly-equal10 for photon energies between 60 and 300 keV. A strong signal and no detectable background are obtained in laser fusion experiments where ~15 J of x rays are released in a pulsed (1 ns), hard (kTroughly-equal200 keV) spectrum. A Lanex/Tri-X phosphor/film combination is used as a focal plane detector; we report its relative energy calibration. Because of the imperfection of available crystals, detailed measurements of reflectivity along the crystal are required to achieve absolute calibration.

6999 **Simplified diamagnetic techniques for a field-reversed theta-pinch plasma.** Tuszewski, M.; Armstrong, W.T. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Review of Scientific Instruments;* **54**: No. 12, 1611-1614(Dec 1983).

Diamagnetic measurements of a field-reversed theta-pinch plasma are performed with a simplified diagnostic consisting of either a single-flux loop and several magnetic probes or magnetic probes only. Numerical and experimental evidence of the validity of these techniques is presented.

7000 **Steepest-descent moment method for three-dimensional magnetohydrodynamic equilibria.** Hirshman, S.P.; Whitson, J.C. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Physics of Fluids;* **26**: No. 12, 3553-3568(Dec 1983). Contract W-7405-ENG-26.

An energy principle is used to obtain the solution of the magnetohydrodynamic (MHD) equilibrium equation J x B-delp = 0 for nested magnetic flux surfaces that are expressed in the inverse coordinate representation x = x(rho, θ, zeta). Here, θ are zeta are poloidal and toroidal flux coordinate angles, respectively, and p = p(rho) labels a magnetic surface. Ordinary differential equations in rho are obtained for the Fourier amplitudes (moments) in the doubly periodic spectral decomposition of x. A steepest-descent iteration is developed for efficiently solving these nonlinear, coupled moment equations. The existence of a positive-definite energy functional guarantees the monotonic convergence of this iteration toward an equilibrium solution (in the absence of magnetic island formation). A renormalization parameter λ is introduced to ensure the rapid convergence of the Fourier series for x, while simultaneously satisfying the MHD requirement that magnetic field lines are straight in flux coordinates. A descent iteration is also developed for determining the self-consistent value for λ.

7001 **Equilibrium and stability properties of high-beta torsatrons.** Carreras, B.A.; Hicks, H.R.; Holmes, J.A.; Lynch, V.E.; Garcia, L.; Harris, J.H.; Hender, T.C.; Masden, B.F. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Physics of Fluids;* **26**: No. 12, 3569-3579(Dec 1983). Contract W-7405-ENG-26.

Equilibrium and stability properties of high-beta torsatrons are investigated using numerical and semianalytical techniques

based on the method of toroidal averaging. The averaged equilibria are compared with those obtained using full three-dimensional codes. Good agreement is obtained, thus validating the averaged method approach. The stability of plasmas for configurations with different aspect ratios and numbers of field periods is studied. The role of the vertical field is also studied in detail. The main conclusion is that for moderate-aspect-ratio torsatrons (A/sub p/< or ≈8), the self-stabilizing effect of the magnetic axis shift is large enough to open a direct path to the second stability region.

7002 **Density and temperature profiles within laser-produced plasmas in the classical-transport regime.** Burkhalter, P.G.; Herbst, M.J.; Duston, D.; Gardner, J.; Emery, M.; Whitlock, R.R.; Grun, J.; Apruzese, J.P.; Davis, J. (Naval Research Laboratory, Washington, DC 20375). *Physics of Fluids;* **26**: No. 12, 3650-3659(Dec 1983).

Using planar polystyrene targets with embedded Al tracer dots, improved x-ray spectroscopic measurements of density and temperature profiles in laser-produced plasmas were obtained. Time-integrated, spatially resolved spectra of the Al tracer emission were collected at laser intensities where the energy absorption and transport is expected to be classical. The plasma density and temperature profiles were determined by comparing the observed x-ray line intensities with collisional-radiative equilibrium calculations. Plasma profiles were obtained for the region blowoff plasma with densities between one-tenth and twice critical for the 1.05 μ laser excitation. Near agreement is found between the measured density and temperature profiles and 2-D (cylindrical) hydrodynamic calculations with energy absorption via classical inverse bremsstrahlung and energy transport via classical thermal conduction.

7003 **Synchrotron emission from runaway electron distributions.** Winske, D.; Peter, T.; Boyd, D.A. (Laboratory for Plasma and Fusion Energy Studies, University of Maryland, College Park, Maryland 20742). *Physics of Fluids;* **26**: No. 12, 3497-3507(Dec 1983).

Synchrotron emission from a relativistic anti-loss-cone (runaway) distribution is investigated numerically and compared with various analytical approximations. The results are applied to recent measurements of enhanced emission during current-drive experiments on the Princeton Large Torus (PLT) as well as to impulsive solar microwave bursts.

7004 **Nonlinear gyrokinetic equations.** Dubin, D.H.E.; Krommes, J.A.; Oberman, C.; Lee, W.W. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Physics of Fluids;* **26**: No. 12, 3524-3535(Dec 1983). Contract AC02-76CH03073.

Nonlinear gyrokinetic equations are derived from a systematic Hamiltonian theory. The derivation employs Lie transforms and a noncanonical perturbation theory first used by Littlejohn for the simpler problem of asymptotically small gyroradius. For definiteness, only electrostatic fluctuations in slab geometry are considered; however, there is a straightforward generalization to arbitrary field geometry and electromagnetic perturbations. An energy invariant for the nonlinear system is derived, and several limiting forms are considered. The weak turbulence theory of the equations is examined. In particular, the wave kinetic equation of Galeev and Sagdeev can ony be derived by an asystematic truncation of the equations, implying that this equation fails to consider all gyrokinetic effects. The equations are simplified for the case of small but finite gyroradius and put in a form suitable for efficient computer simulation. Although it is possible to derive the Terry—Horton and Hasegawa—Mima equations as limiting cases of our theory, several new nonlinear terms absent from conventional theories appear and are discussed. The resulting theory is very similar in content to the recent work of Lee. However, the systematic nature of our derivation provides considerable insight into the structure and interpretation of the equations.

7005 **Turbulent relaxation of compressible plasmas with flow.** Finn, J.M.; Antonsen, T.M. Jr. (Laboratory for Plasma and Fusion Energy Studies, University of Maryland, College Park, Maryland 20742). *Physics of Fluids;* **26**: No. 12, 3540-3552(Dec 1983). Contract AC05-77ET53044.

Relaxation of compressible plasmas to an equilibrium with flows is studied. The magnetohydrodynamic (MHD) equations with large parallel thermal conductivity and ergodic field lines show that ∫vxB is an invariant even with compression. Also, S = ∫rho ln(p/rho/sup γ/) is the only entropy-like invariant of the MHD equations with infinite parallel thermal conductivity; S increases in time with finite thermal conductivity. The other invariants are energy, helicity ∫AxB, mass ∫rho, and possibly angular momentum. Equilibria are found by extremizing energy while conserving these invariants or by maximizing entropy with the energy and other invariants as constraints. These invariants are complete in the sense of generating all equilibria that form after relaxation with ergodic field lines. For parallel flows, there are three classes of solutions characterized by the sign of drho/dB² and the mirror mode parameter. A sufficient condition for stability is derived. This condition is never satisfied by the class with drho/dB²>0, indicating the possibility of unstable resistive interchanges. The class with drho/dB²<0 is stable if generalizations of the local firehose and mirror criteria are satisfied, and if generalized Taylor helicity eigenvalues exceed those of the equilibrium. A comparison of these conditions with those of Frieman and Rotenberg is discussed.

7006 **Electromagnetic integral equation: Application to microtearing modes.** Farengo, R.; Lee, Y.C.; Guzdar, P.N. (Laboratory for Plasma and Fusion Energy Studies, University of Maryland, College Park, Maryland 20742). *Physics of Fluids;* **26**: No. 12, 3515-3523(Dec 1983).

The integral equation technique previously developed for electrostatic drift waves to study low-frequency electromagnetic perturbation is extended. When σ/sub e/>>σ/sub i/ (as is the case for tearing modes) the problem can be reduced to the simultaneous solution of an integral and a differential equation. Using a Fourier representation for phi-tilde(x), a differential equation is derived from Ampere's law for a modified Green's function that contains the magnetic effects. This equation is solved simultaneously with an integral equation (corresponding to the quasineutrality condition in k space) to obtain the eigenvalues and corresponding eigenfunctions. When applied to the study of microtearing modes this method gave, for the same values of the parameters, larger growth rates than those of the usual differential approximation.

7007 **Ballooning instabilities in hot electron plasmas.** Antonsen, T.M. Jr.; Lee, Y.C.; Berk, H.L.; Rosenbluth, M.N.; Van Dam, J.W. (Laboratory for Plasma and Fusion Energy Studies, University of Maryland, College Park, Maryland 20742). *Physics of Fluids;* **26**: No. 12, 3580-3594(Dec 1983). Contract AC05-77ET53044.

The stability of short-wavelength, low-frequency modes in a hot electron plasma is investigated. Particular attention is devoted to the effect of the dependence of perturbed quantities along the equilibrium magnetic field lines. Two types of modes in a bumpy torus are considered: modes which are nearly flutes in each mirror cell but vary in phase from cell to cell, and modes which have significant variation in each cell. Generally speaking, allowing perturbations to vary along the field lines is destabilizing. However, sufficiently large hot electron gyroradii can stabilize all short perpendicular wavelength modes.

7008 **Beam—ion and alpha-particle effects on microinstabilities in tokamaks.** Rewoldt, G.; Tang, W.M. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Physics of Fluids;* **26**: No. 12, 3619-3623(Dec 1983). Contract AC02-76CH03073.

The analysis of electromagnetic kinetic toroidal eigenmodes for general magnetohydrodynamic (MHD) equilibria has been extended to include the effects of non-Maxwellian equilibrium distribution functions. This is necessary to properly represent the response of the hot-beam—ion species produced during neutral-beam injection heating and the response of the alpha-particle species in a thermonuclear plasma. The influence of these components on low-frequency microinstabilities is investigated for realistic cases typical of the PLT and PDX tokamak experiments.

7009 **Energy conservation and related constraints in drift wave turbulence.** Thayer, D.R.; Molvig, K. (Institute for Fusion Studies, University of Texas at Austin, Austin, Texas 78712 and Plasma Fusion Center, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physics of Fluids;* **26**: No. 12, 3536-3539(Dec 1983). Contract FG05-80ET53088.

The problem of energy conservation for the renormalization of the drift wave instability in a sheared magnetic field is considered. It has been suggested previously that there is a connection between a certain constraint on the nonlinear term in the drift kinetic equation and energy conservation. Arguments are presented to dissolve this connection; and in turn, energy conservation is formulated in the physically meaningful statistically averaged sense. Finally, energy conservation is proven for the system of nonlinear equations, renormalized by the normal stochastic approximation, describing the drift wave instability.

7010 **Destabilization of the hot-electron precessional mode in tandem mirrors and bumpy tori.** Baldwin, D.E.; Berk, H.L. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Physics of Fluids;* **26**: No. 12, 3595-3601(Dec 1983). Contract W-7405-ENG-48.

The high-frequency precessional mode of a hot-electron-stabilized magnetic configuration has previously been shown to be stable in a window of core-plasma mass. Under conditions of frequency matching, the resulting stable negative-energy precessional wave can be destabilized by coupling to positive-energy shear-Alfven waves. Coupling is avoided when the hot-electron precession frequency exceeds the core-plasma ion gyrofrequency.

7011 **Computer simulations of upper-hybrid and electron cyclotron resonance heating.** Lin, A.T.; Lin, C.C. (Department of Physics, University of California, Los Angeles, California 90024). *Physics of Fluids;* **26**: No. 12, 3612-3618(Dec 1983). Contract AM03-76SF00010.

A 2 1/2 -dimensional relativistic electromagnetic particle code is used to investigate the dynamic behavior of electron heating around the electron cyclotron and upper-hybrid layers when an extraordinary wave is obliquely launched from the high-field side into a magnetized plasma. With a large angle of incidence most of the radiation wave energy converts into electrostatic electron Bernstein waves at the upper-hybrid layer. These mode-converted waves propagate back to the cyclotron layer and deposit their energy in the electrons through resonant interactions dominated first by the Doppler broadening and later by the relativistic mass correction. The line shape for both mechanisms has been observed in the simulations. At a later stage, the relativistic resonance effects shift the peak of the temperature profile to the high-field side. The heating ultimately causes the extraordinary wave to be substantially absorbed by the high-energy electrons. The steep temperature gradient created by the electron cyclotron heating eventually reflects a substantial part of the incident wave energy. The diamagnetic effects due to the gradient of the mode-converted Bernstein wave pressure enhance the spreading of the electron heating from the original electron cyclotron layer.

7012 **Absolutely timed x-ray streak camera for laser fusion experiments.** Letzring, S.A.; Thorsos, E.I.; Friedman, W.D.; Seka, W.; Rizzo, J.E. (Laboratory for Laser Energetics, University of Rochester, Rochester, New York 14623). *Journal of Applied Physics;* **54**: No. 11, 6302-6306(Nov 1983). Contract AC08-80DP40124.

We report on the design and performance characteristics of an absolutely timed x-ray streak camera. The camera displays UV(4ω) laser fiducials along side multichannel x-ray streaks thus allowing absolute timing of the x-ray signals relative to the laser pulse. As illustration, the implosion times of spherically irradiated microballoons have been measured with this instrument and the results agree well with hydrocode predictions.

7013 **Finite—pressure-gradient influences on ideal spheromak equilibrium.** Hart, G.W.; Chin-Fatt, C.; DeSilva, A.W.; Goldenbaum, G.C.; Hess, R.; Shaw, R.S. (Laboratory for Plasma and Fusion Energy Studies, University of Maryland, College Park, Maryland 20742). *Physical Review Letters;* **51**: No. 17, 1558-1561(24 Oct 1983).

Spatially resolved measurements of the magnetic field of a spheromak have been analyzed and compared with expectations for the ratio of j/sub parallel//B from the pressure gradient-free Taylor model and a model with pressure due to Morikawa. Better agreement is found with the model containing finite pressure.

7014 **Anode-plasma expansion in pinch-reflex diodes.** Colombant, D.G.; Goldstein, S.A. (Naval Research Laboratory, Washington, DC 20375). *Physical Review Letters;* **51**: No. 17, 1562-1565(24 Oct 1983).

Anode-plasma expansion in pinch-reflex diodes is investigated with use of a one-dimensional magnetohydrodynamic model. Early in time, the plasma undergoes thermal expansion and its front is slowed down as a result of j x B. After the current has reached its maximum and for small radius where j and B are larger, j x B may accelerate the bulk of the anode plasma to large velocities. Good qualitative agreement is obtained with observations of the time dependence of the plasma velocity as well as its radial profile. The maximum expansion velocities reach tens of centimeters per microsecond.

7015 **Nonlinear competition between stimulated Brillouin-scattered light waves in plasmas.** Berger, R.L. (KMS Fusion, Incorporated, Ann Arbor, Michigan 48106). *Physical Review Letters;* **51**: No. 17, 1554-1557(24 Oct 1983). Contract AC08-82DP40152.

Nonlinear equations are solved which describe the competition between two decay modes for laser light energy. When they are applied to the competition between Brillouin forward- and backward-scattered light, multivalued solutions occur for plasmas between two limiting sizes. Application to particular experiments may explain the appearance of either red- or blue-shifted peaks or both in time-integrated spectra.

7016 **Numerical evaluation of magnetic coordinates for particle transport studies in asymmetric plasmas.** Kuo-Petravic, G.; Boozer, A.H.; Rome, J.A.; Fowler, R.H. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Journal of Computational Physics;* **51**: No. 2, 261-363(Aug 1983). Contract AC02-76CH03073.

A numerical procedure is described for the evaluation of magnetic coordinates given a toroidal, scalar pressure plasma with an arbitrary magnetic field. The accurate representation of magnetic field strength in this way is invaluable for the calculation of drift orbits and transport in asymmetric plasmas.

7017 **Theory of steady state plasma flow and confinement in a periodic magnetic field.** Brown, M.G. London, England; Imperial College of Science and Technology (1981). 176p. British Library, Boston Spa, Wetherby, West Yorks. No. D70279/81.

Thesis.

The steady flow of plasmas through spatially periodic magnetic fields is examined, and a theoretical model is developed for the case of axisymmetric geometry. The externally applied magnetic fields can be cusps or mirrors joined end to end; electrons are then localised by these fields because of their small Larmor radius, while the ions can traverse the magnetic mirrors. The properties of the model equations are studied and dimensionless parameters which appear are interpreted. Numerical methods used in steady flow applications are reviewed, and some techniques of solution for the model equations are discussed. A solution method involving numerical integration of time-dependent equations is described, which approaches the steady state asymptotically; results from this method are presented and compared with the results from perturbation theory.

7018 **Radiation pressure effects in laser produced plasmas.** Willi, O. Oxford, England; Oxford University (1980). 124p. British Library, Boston Spa, Wetherby, West Yorks. No. D37359/81.

Thesis.

Electron density profiles in laser produced plasmas, steepened due to the radiation pressure of the laser light, have been measured interferometrically and are modelled by a one-dimensional hydrodynamic computer code in which the ponderomotive force has been included. Interferometric measurements of electron density profiles on spherical targets irradiated at intensities of 10^{15} to $10^{16}Wcm^{-2}$ by a 50 psec (FWHM) Gaussian Nd glass laser pulse (lambda = 1.06 μm) have been made either with a frequency doubled (lambda = 0.532μm) or with a frequency quadrupled (lambda = 0.266μm) probe beam. During the laser pulse strong profile steepening near critical density is observed whereas after the laser pulse a supercritical density bump with a considerable low density structure is seen.

7002 Fusion Power Plant Technology

REFER ALSO TO CITATION(S) 6142, 6143, 6144, 6145, 6146, 6154, 6155, 6365, 6366, 6398, 6421, 6422, 6482, 7002, 7012

7019 **(CONF-821108—32) Internally Cooled Cable Superconductor (ICCS) for TF and PF coils of FED.** Srivastava, V.C.; Lue, J.W.; Lubell, M.S. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE84003365.

From Applied superconductivity conference; Knoxville, TN, USA (30 Nov 1982).

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Internally Cooled Cable Superconductor (ICCS) concepts developed for TF and PF coils of FED are described. These concepts represent one of the options for FED, and other conductor concepts are still being explored, i.e., no decision has been made for the conductor concepts to be utilized for FED. The TF coil conductor design is based on an ICCS successfully used in a small test magnet at ORNL. The conductor consists of triplets of NbTi strands loosely packed in a stainless steel conduit similar to the Westinghouse LCP coil. The operating current for the conductor is 25.5 kA at l0T and 3.1°K. The conductor is co-wound with a stainless steel C-shaped channel to provide a direct load path to the coil case for the accumulated magnetic loads in the winding. The strand diameter in the conductor is optimized to reduce the eddy current losses. The nuclear heating in the winding is the most dominant heat load. In order to remove these heat loads due to nuclear heating and ac losses in the winding, it is necessary to lower the inlet temperature of helium to 2.2°K. The conductor has a thermal capacity of ~ 200 mJ/cc, which provides a comfortable stability margin under the operating conditions.

7020 **(CONF-830758—) Advanced bumpy torus concepts.** Uckan, N.A. (ed.). (Oak Ridge National Lab., TN (USA); Applied Microwave Plasma Concepts, Inc., Encinitas, CA (USA)). Oct 1983. Contract W-7405-ENG-26. 427p. NTIS, PC A19/MF A01. Order Number DE84002406.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

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Separate abstracts were prepared for 24 of the included papers. (MOW)

7021 (CONF-830758—, pp 19-33) **Advanced bumpy torus concepts: workshop overview.** Krall, N.A. (JAYCOR, San Diego, CA). Oct 1983. NTIS, PC A19/MF A01.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

7022 (CONF-830758—, pp 37-53) **Drift surface studies of EBT configurations with noncircular magnetic coils.** Miller, R.L.; Dandl, R.A.; Guest, G.E. (AMPC Inc., Encinitas, CA). Oct 1983. NTIS, PC A19/MF A01. Contract AC03-82ER51030.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

We have carried out a systematic comparison of the drift surface properties of a number of noncircular magnetic coil geometries for EBT. The most promising configuration we have identified is the shifted Andreoletti coil set (racetrack coils which are alternately positioned horizontally and vertically). By adjusting height-to-width ratios and a radial shift parameter, it is possible to make trapped and passing particle orbits nearly coincide indicating greatly enhanced confinement. Furthermore, at large aspect ratio, even the resonant particle drift orbits are closed and nearly circular. Thus resonant particle losses should be greatly reduced as well.

7023 (CONF-830758—, pp 67-70) **Minimum-B mirrors plus EBT principles.** Yoshikawa, S. (Princeton Plasma Physics Lab., NJ). Oct 1983. NTIS, PC A19/MF A01. Contract AC02-76CH03073.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

Electrons are heated at the minimum B location(s) created by the multipole field and the toroidal field. Resulting hot electrons can assist plasma confinement by (1) providing mirror, (2) creating azimuthally symmetric toroidal confinement, or (3) creating modified bumpy torus.

7024 (CONF-830758—, pp 73-95) **Magnetics of innovative bumpy tori.** Mai, L.P.; Gibson, G. (Westinghouse Advanced Energy Systems Div., Madison, PA). Oct 1983. NTIS, PC A19/MF A01.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

The Bumpy Bean Torus consists of a conventional bumpy torus coil arrangement except that the coils are bean-shaped rather than circular. The indentations of the bean coils face the major axis of the torus. A second concept is identified as a Bumpy Polygon and it is composed of a closed array of linear mirror devices connected by short high field regions where particle trapping will be minimized. The particles are confined primarily in the system of linear mirror regions. For both of these closed-flux-line geometries the flux lines in the inner bore area are comparable in length to the outer bore region. The volume for good single particle confinement is expected to be increased, and the neoclassical transport loss is expected to be reduced relative to the conventional bumpy torus. Energetic electron rings similar to those used in the Elmo Bumpy Torus (EBT) are required for plasma stability. Preliminary results from calculations of magnetics properties such as flux shapes, mod-B surfaces, particle drift surfaces, and plasma pressure surfaces, will be presented.

7025 (CONF-830758—, pp 99-116) **Optimized approaches to EBT's with simple circular coils.** Pipkins, J.F.; Schmitt, R.J.; Ard, W.B.; Kashuba, R.J.; Bieniosek, F.M. (McDonnell Douglas Astronautics Co., St. Louis, MO). Oct 1983. NTIS, PC A19/MF A01.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

Several approaches have been proposed for magnetic configurations for EBT that reduce the dispersion in drift orbits and increase the fraction of orbits confined in the device over those in a simple bumpy torus. In this paper we qualitatively compare two approaches using simple circular coils, with and without rotational transform. The devices we compare consist of two linear segments of simple mirrors connected at the ends with segments of a torus. In one device the two linear segments do not lie in the same plane so that the toroidal connection results in the establishment of flux surfaces rather than closed field lines. The projection of the resulting flux surfaces are concentric circles that coincide with the drift surfaces of particles trapped in the mirror segments. Both devices are EBT's in that they require magnetic mirrors for the equilibrium and high beta rings to provide MHD stability for both low and high core beta. Devices based on the twisted racetrack approach offer advantages over circular EBT's for reactor applications as well as for experimental devices.

7026 (CONF-830758—, pp 117-150) **Preliminary conceptual design of a twisted racetrack EBT device.** DeBellis, R.J.; Imster, H.F.; Conlee, J.L.; Dannenmueller, R.J.; Dillow, C.F.; Poteat, T.J.; Schmitt, R.J. (McDonnell Douglas Astronautics Co., St. Louis, MO). Oct 1983. NTIS, PC A19/MF A01.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

A twisted racetrack alternative to the usual type of EBT device consists of two straight sections with EBT mirrors connected by two end segments in the form of simple toroidal solenoids. The straight sections are separated vertically by several meters to produce a non-planar device with a rotational transform. The engineering aspects of a twisted racetrack device are considered in this paper, with emphasis on magnet, vacuum vessel and main support structure. Three configurations are discussed, a steady state concept with superconducting coils, a pulsed concept with copper coils and a hybrid concept with both copper and superconducting coils. Areas of unusual or difficult design aspects are identified and preliminary cost estimates are presented and compared to cost estimates generated previously for EBT-P.

7027 (CONF-830758—, pp 151-160) **Analytical studies on characteristics of new bumpy torus configuration.** Tsushima, A.; Fujiwara, M. (Nagoya Univ., Japan). Oct 1983. NTIS, PC A19/MF A01.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

Theoretical studies are carried out to develop a new bumpy torus configuration without deterioration of its various advantages against other fusion devices such as tokamaks, stellarators and so on. In this configuration plasmas are confined by finite magnetic rotational transform which is localized in the central core region and stabilized by hot electron annulus at the peripheral region. By using expansion method around the magnetic axis, necessary field components and various magnetic surface quantities are investigated to evaluate the confinement characteristics of this configuration. Coil structures to provide such fields are also examined.

7028 (CONF-830758—, pp 161-166) **Elmo Snakey Torus.** Boozer, A.H. (Princeton Plasma Physics Lab., NJ). Oct 1983. NTIS, PC A19/MF A01.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

In the Elmo Snakey Torus (EST), circular toroidal field coils are displaced along a helical path to produce a magnetic configuration with surfaces. One such surface is illustrated. A hot electron annulus is used to overcome the pressure driven instabilities, which are predicted for EST plasmas, during the start-up phase. After the beta value is raised above about 10%, the Shafranov shift has a strong stabilizing effect on the pressure driven modes and the electron annulus should not be required at the operating beta value which is about 20%.

7029 (CONF-830758—, pp 179-190) **Optimized operation of bumpy torus.** Ikegami, H. (Nagoya Univ., Japan). Oct 1983. NTIS, PC A19/MF A01.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

On developing a new concept for the bumpy torus, one is supposed to have a clear understanding of plasmas in the currently operating two bumpy tori, Nagoya Bumpy Torus (NBT) and Elmo Bumpy Torus (EBT). Any new concepts would propose to improve some of the undesirable features of the present bumpy torus concept in exchange for introducing a little bit of gimmick hopefully harmless. Optimization of the bumpy torus is considered with respect to density, temperature, confinement, beta, and stability.

7030 (CONF-830758—, pp 217) **Comparison of magnetic equilibria and low frequency stability for EBT and EBS.** Hedrick, C.L. (Oak Ridge National Lab., TN). Oct 1983. NTIS, PC A19/MF A01. Contract W-7405-ENG-26.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

7031 (CONF-830758—, pp 421-435) **Reduction of microwave power requirements for EBT.** Hamasaki, S.; Klein, H.H.; Krall, N.A.; Sperling, J.L. (JAYCOR, San Diego, CA). Oct 1983. NTIS, PC A19/MF A01.

From Workshop on advanced bumpy torus concepts; Rancho Santa Fe, CA, USA (11 Jul 1983).

Power requirements for EBT electron ring formation are calculated based on the assumption that the ring electrons originate as runaways accelerated by the first harmonic resonance of the extraordinary mode. The minimum power, P/sub μ/, for startup is shown to scale roughly linearly with the background plasma density (P/sub μ/ proportional to n/sub e/). On the other hand, the microwave power required to maintain the constant bulk electron temperature increases as the square of the plasma density (P/sub μ/ proportional to n^2). It is therefore suggested that more economical EBT operation in high density regimes (n/sub e/ $\simeq 10^{13}$ to 10^{14} cm^{-3}) can be obtained by utilizing alternate and less expensive power sources for bulk plasma heating, using the minimum required microwave power to start up the energetic electron annulus.

7032 **(CONF-830795—6) Particle removal with pump limiters in ISX-B.** Mioduszewski, P.; Emerson, L.C.; Simpkins, J.E.; Wootton, A.J.; Bush, C.E.; Carnevali, A.; Dunlap, J.L.; Edmonds, P.H.; Gardner, W.L.; Howe, H.C. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA); Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract W-7405-ENG-26. 29p. NTIS, PC A03/MF A01. Order Number DE84003263.

From Symposium on energy removal and particle control and toroidal fusion devices; Princeton, NJ, USA (26 Jul 1983).

First pump limiter experiments were performed on ISX-B. Two pump limiter modules were installed in the top and bottom of one toroidal sector of the tokamak. The modules consist of inertia cooled, TiC coated graphite heads and Zr-Al getter pumps each with a pumping speed of 1000 to 2000 l/s. The objective of the initial experiments was the demonstration of plasma particle control with pump limiters. The first set of experiments were performed in ohmic discharges (OH) in which the effect of the pump limiters on the plasma density was clearly demonstrated. In discharges characterized by: I/sub p/ = 110 kA, B/sub T/ = 15 kG, anti n/sub e/ = 1 - 5 x 10^{13} cm^{-3} and t = 0.3 s the pressure rise in the pump limiters was typically 2 mTorr with the pumps off and 0.7 mTorr after activating the pumps. When the pumps were activated, the line-average plasma density decreased by up to a factor 2 at identical gas flow rates. The second set of measurements were performed in neutral beam heated discharges (NBI) with injected powers between 0.6 MW and 1.0 MW. Due to a cooling problem on one of the Zr-Al pumps the NBI experiments were carried out with one limiter only. The maximum pressure observed in NBI-discharges was 5 mTorr without activating the pumps, i.e., approximately twice as high as in OH-discharges. The exhaust efficiency, which is defined as the removed particle flux over the total particle flux in the scrape-off layer is estimated to be 5%.

7033 **(CONF-830908—8) ATF-1 torsatron studies.** Lyon, J.F.; Carreras, B.A.; Charlton, L.A.; Cooper, W.A.; Dory, R.A.; Fowler, R.H.; Garcia, L.; Harris, J.H.; Hender, T.C.; Hicks, H.R. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE84003314.

From 11. European conference on controlled fusion and plasma physics; Aachen, F.R. Germany (5 Sep 1983).

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The main advances in the ORNL Stellarator Program since the 1982 IAEA Conference have been: (1) engineering design of the ATF-1 torsatron; (2) extension of 3-D MHD equilibrium and stability studies and calculations of helical axis configurations; (3) study of stable equilibria with $\langle\beta\rangle \geqq 8\%$ and direct access to the second stability regime; (4) 3-D Monte Carlo and analytic transport calculations which show a large reduction in transport at low collisionality for the absolute value of e phi'/T' $\geqq$ 1; (5) calculation of ambipolar electric fields; and (b) calculation of well confined ion drift surfaces in the ergodic field region outside the last closed flux surface.

7034 **(CONF-830909—10) EBT concept: status, plans, and reactor potential.** Swain, D.W. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 42p. NTIS, PC A03/MF A01. Order Number DE84003311.

From Course and workshop on mirror-based and field-reversed approaches to magnetic fusion; Varenna, Italy (7 Sep 1983).

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This paper will consist of four parts. First, I will describe the basic EBT machine and its operation. Second, I will discuss the experimental results obtained on the present machine and how they relate to neoclassical transport theory. This will include a discussion of the chronology of the estimates of the confinement time and why they have changed. Third, I will briefly discuss some preliminary proposals on how to improve the confinement and operation of EBTs, and fourth, I will review some of the potential advantages of EBTs as fusion reactors and the calculations indicating the critical issues.

7035 **(CONF-830942—66) Copper and copper alloys for fusion reactor applications: summary report of a DOE-OFE workshop.** Wiffen, F.W.; Reuther, T.C.; Gold, R.E. (Oak Ridge National Lab., TN (USA); Department of Energy, Washington, DC (USA). Office of Fusion Energy; Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Energy Systems Div.). 1983. Contract W-7405-ENG-26. 3p. NTIS, PC A02/MF A01. Order Number DE84003410.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

The Office of Fusion Energy of the US Department of Energy convened a workshop in April 1983 to review the needs for copper and copper alloys in fusion device applications. The adequacy of the data base on these materials was examined, and recommendations were developed for experimental programs needed to fill identified data gaps. The workshop results are available in a conference proceedings.

7036 **(CONF-830971—7) Lessons from design and manufacture of US LCT coils.** Kibbe, R.K.; Haubenreich, P.N.; Gerwig, C.H.; Hackley, D.S.; Sanger, P.A.; Young, J.L. (Oak Ridge National Lab., TN (USA); General Electric Co., Schenectady, NY (USA); General Dynamics Corp., San Diego, CA (USA). Convair Div.; Oxford Airco, Carteret, NJ (USA); Westinghouse Electric Corp., East Pittsburgh, PA (USA)). 1981. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE84003165.

From 8. international conference on magnet technology and exhibition; Grenoble, France (5 Sep 1983).

In the international Large Coil Task (LCT), US industrial teams have finished one coil and are nearing completion of two others. Of the lessons learned, the ones that apply most widely to advanced technology development have to do with the difficulty of scheduling progress in a novel undertaking. Reasons for schedule stretch-out are discussed in this paper. The major factor in the LCT was the discovery by all participants of more technical problems than could have been foreseen. Also, the effort implicit in the demands for reliability and quality were greater than appreciated at first. Other factors were changes in requirements during the projects and restrictions on effort due to budget constraints. LCT experience should be particularly useful in scheduling development of superconducting coils for tokamak fusion reactors.

7037 **(CONF-831171—16) Correction of a vacuum design fault in leak detectors.** Langley, R.A. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE84003393.

From American Vacuum Society meeting; Boston, MA, USA (1 Nov 1983).

This paper describes a vacuum design fault in the Veeco Model MS 170 Leak Detector and provides a simple and inexpensive solution to correct the fault.

7038 **(DOE/DP/40158—1) Neutron radiation effects on the structure of the particle beam fusion target development facility. Final project report, 3 September 1981-31 March 1983.** Ghoniem, N.M. (California Univ., Los Angeles (USA). Center for Plasma Physics and Fusion Engineering). Jul 1983. Contract AS08-81DP40158. 48p. NTIS, PC A03/MF A01. Order Number DE84003809.

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Neutron damage to the structural material for the Target Development Facility (TDF) is addressed in this study. Even though the End-Of-Life (EOL) neutron fluences are expected to be low, the instantaneous radiation intensity leads to significant changes in mechanical properties. Neutron damage is produced at a very high rate (10^6 to 10^7 times faster than corresponding neutron test facilities) for a short period of time followed by a quiescent phase. During this phase the material recovers part of the damage. Because of the intended operation of the TDF at room temperature, the damage is only partially recovered. Since many material properties are quite sensitive to the displacement damage rate, the properties in this case will be determined mainly by the damage rate and not the integrated neutron fluence. In the present research, a theory is developed for radiation hardening and embrittlement of ferritic alloys appropriate for low temperature applications. The rapid clustering of point defects is shown to result in significant hardening and shift in the Ductile-to-Brittle-Transition-Temperature (DBTT), especially at room temperature. It is desirable, therefore, to use an austenitic stainless steel alloy as a structural material for the TDF cavity. Another acceptable approach might be a periodic annealing treatment of the proposed HT-9 ferritic alloy to avoid permanent neutron radiation embrittlement.

7039 (DOE/ER—0045/10, pp 3-4) **Low activation approaches to materials development.** Gelles, D.S.; Brager, H.R.; Garner, F.A. (Westinghouse Hanford Co., Richland, WA). Oct 1983. NTIS, PC A10/MF A01.

In Alloy development for irradiation performance. Semiannual progress report for period ending March 31, 1983.

An effort has been initiated to develop low-activation alloys for fusion reactor service. Several major compositional regimes have been identified for development. The approach employed has been to develop low activation alloys via routes which may mitigate previously identified materials problems.

7040 **(EPRI-AP—3229) Conceptual design of a moving-ring fusion reactor. AP-3229 Research Project 922, annual report, October 1983.** (Pacific Gas and Electric Co., San Francisco, CA (USA); Lawrence Livermore National Lab., CA (USA); Cornell Univ., Ithaca, NY (USA). School of Applied and Engineering Physics; General Atomic Co., San Diego, CA (USA); Michigan Univ., Ann Arbor (USA). Dept. of Nuclear Engineering). Oct 1983. Contract W-7405-ENG-48. 418p. NTIS, PC A18/MF A01. Order Number DE84003803.

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This report concludes a two-year project to design a prototype (roughly 100 MW(e) net) fusion power plant which places emphasis on commercial needs and to outline a development plan for it. This project is a follow-on to an earlier design of a small (11 MW(e) net) pilot power plant (EPRI Report AP-1544), which is included in the development plan as a step to be built before this prototype. The prototype design put major attention on minimizing nuclear issues. Other commercial matters, including suitability for scaling to a wide range of sizes, were also very important. The design, the earlier pilot design, and the extrapolation of these to commercial size designs identify gaps between required technical features and current technical knowledge. These gaps set targets for experiments and technology programs. These programs and designs define the development plan.

7041 (INIS-mf—8672, pp 64) **Advanced fuels and their application in fusion reactors.** Heindler, M.; Kernbichler, W.; Lackner, W.; Nassri, A.; Niederl, K.; Riedler, H. (Technische Univ., Graz (Austria). Inst. fuer Theoretische Physik und Reaktorphysik). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. (CONF-8309179—Absts.).

From Annual convention of the Austrian Physical Society; Linz, Austria (28 Sep 1983).

7042 **(KMSF-U—1315) Quarterly progress report, October-December 1982.** (KMS Fusion, Inc., Ann Arbor, MI (USA)). 1982. Contract AC08-82DP40152. 34p. NTIS, PC A03/MF A01. Order Number DE84002940.

In this final Quarterly Progress Report for 1982, we conclude our series on energy transport by thermal electrons with a discussion of spherical-target transport experiments performed with 0.53 μm light. We also present x-ray photocathode sensitivity measurements taken at 0.266 μm, which will enable us to add optical timing fiducials to time-resolved x-ray records. Our investigation into the nature of collision-less heat flow, where the scale lengths are short compared to the scattering mean-free paths, snows that the distortion of the electron spectrum varies with time and hence the flux limit value should vary with time. Finally, a recent advancement in Brillouin scattering shows that the forward-scattering wave may dominate over the backward-scattered wave under certain conditions. This effect may help to explain the levels and distributions of scattered light in several past experiments.

7043 **(LA—9717-MS) ZT-40M current risetime study.** Phillips, J.A.; Burkhardt, L.C.; Haberstich, A.; Howell, R.B.; Ingraham, J.C.; Little, E.M.; Thomas, K.S.; Watt, R.G.; Weber, P.G. (Los Alamos National Lab., NM (USA)). Oct 1983. Contract W-7405-ENG-36. 37p. NTIS, PC A03/MF A01. Order Number DE84003563.

A study of discharge risetimes was undertaken in the reversed-field pinch (RFP) experiment, ZT-40M, to obtain guidelines for future larger and slower experiments. The electrical circuits allowed nominal risetimes of 0.25 to 1.5 ms and peak toroidal currents were ≦ 180 kA. For the longer risetimes optimized operation occurs at higher fill pressures which leads to larger radiation losses, a larger poloidal flux consumption, and a larger fraction of the energy input being lost by the time of peak toroidal current.

7044 **(LA-UR—83-3415) Subsystem cost data for the tritium systems test assembly.** Bartlit, J.R.; Anderson, J.L.; Rexroth, V.G. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 8p. (CONF-831203—32). NTIS, PC A02/MF A01. Order Number DE84003822.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Details of subsystem costs are among the questions most frequently asked about the $14.4 million Tritium Systems Test Assembly (TSTA) at Los Alamos National Laboratory. This paper presents a breakdown of cost components for each of the 20 major subsystems of TSTA. Also included are details to aid in adjusting the costs to other years, contracting conditions, or system sizes.

7045 **(SAND—83-1621C) Light ion fusion.** VanDevender, J.P. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 6p. (CONF-831203—26). NTIS, PC A02/MF A01. Order Number DE84003767.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The Inertial Confinement Fusion Program with Light Ion Drivers is developing high intensity ion beam driver technology on PBFA I and will apply that technology to study implosion hydrodynamics of small fuel masses on PBFA II. Power concentration is the key issue. The research on beam production and focusing is interpreted to give guidelines for future research in the ICF Program. Recent progress is reviewed briefly and the impact of recently discovered problems of ion impurities and beam energy spread are discussed. The lithium ion option for PBFA II has been chosen and the first PBFA II diode will be the Applied-B diode.

7046 **(UCRL—89235) Circular waveguide systems for electron-cyclotron-resonant heating of the tandem mirror experiment-upgrade.** Felker, B.; Calderon, M.O.; Chargin, A.K.; Coffield, F.E.; Gallagher, N.C. Jr.; Lang, D.D.; Pedrotti, L.R.; Rubert, R.R.; Stallard, B.W.; Sweeney, D.W. (Lawrence Livermore National Lab., CA (USA)). 18 Nov 1983. Contract W-7405-ENG-48. 6p. (CONF-831203—21). NTIS, PC A02/MF A01. Order Number DE84003739.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Extensive use of electron cyclotron resonant heating (ECRH) in the Tandem Mirror Experiment-Upgrade (TMX-U) requires continuous development of components to improve efficiency, increase reliability, and deliver power to new locations with respect to the plasma. We have used rectangular waveguide components on the experiment and have developed, tested, and installed circular waveguide components. We replaced the rectangular with the circular components because of the greater transmission efficiency and power-handling capability of the circular ones. Design, fabrication, and testing of all components are complete for all systems. In this paper we describe the design criteria for the system.

7047 **(UCRL—89237) Organization and performance of the neutral beam system for the Tandem Mirror Experiment-Upgrade (TMX-U).** Kane, R.J.; Hibbs, S.M.; Kerr, R.G.; Poulsen, P. (Lawrence Livermore National Lab., CA (USA)). 23 Nov 1983. Contract W-7405-ENG-48. 6p. (CONF-831203—16). NTIS, PC A02/MF A01. Order Number DE84003732.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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The Tandem Mirror Experiment-Upgrade (TMX-U) at Lawrence Livermore National Laboratory (LLNL) uses 24 neutral-beam injectors to heat and fuel the experimental plasmas. This system is unique because TMX-U operates four times more injectors than any other fusion experiment. These injectors deliver an average of 50 A (accel) at 17 keV for 75 ms. Source conditioning time has been reduced to approximately four days for the entire system after extended machine air cycles. TMX-U is also unique because it has 35 usable injector assemblies for the 24 power systems. This quantity of injectors makes possible the development of new hardware and injector modifications, and the reconditioning of damaged sources without affecting machine operation. Efficient operation of a system of this size requires coordinated interaction between the injector service groups and the physics organization. We describe the current state of TMX-U performance and the aspects of group interaction essential to a project of this size.

7048 **(UCRL—89238) Applications of small computers for systems control on the Tandem Mirror Experiment-Upgrade.** Bork, R.G.; Kane, R.J.; Moore, T.L. (Lawrence Livermore National Lab., CA (USA)). 29 Nov 1983. Contract W-7405-ENG-48. 5p. (CONF-831203—25). NTIS, PC A02/MF A01. Order Number DE84003752.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Desktop computers operating into a CAMAC-based interface are used to control and monitor the operation of the various subsystems on the Tandem Mirror Experiment-Upgrade (TMX-U) at Lawrence Livermore National Laboratory (LLNL). These systems include: shot sequencer/master timing, neutral beam control (four consoles), magnet power system control, ion-cyclotron resonant heating (ICRH) control, thermocouple monitoring, getter system control, gas fueling system control, and electron-cyclotron resonant heating (ECRH) monitoring. Two additional computers are used to control the TMX-U neutral beam test stand and provide computer-aided repair/test and development of CAMAC modules. These machines are usually programmed in BASIC, but some codes have been interpreted into assembly language to increase speed. Details of the computer interfaces and system complexity are described as well as the evolution of the systems to their present states.

7049 **(UCRL—89255) Physics requirements for pellet fueling of mirror reactors.** Hamilton, G.W. (Lawrence Livermore National Lab., CA (USA)). 15 Nov 1983. Contract W-7405-ENG-48. 10p. (CONF-831203—27). NTIS, PC A02/MF A01. Order Number DE84003239.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Requirements for pellet fueling of mirror reactors, such as the Mirror Advanced Reactor Study (MARS), have been assessed. To avoid perturbing the MARS central-cell plasma density more

than 10%, we have determined that the fuel injected per pellet must not exceed 2 x 10^{21} deuterium-tritium (DT) atoms. This implies a maximum radius of 2 mm for each of the frozen DT pellets and a repetition rate of at least 6.2 pellets/s. Furthermore, the required pellet velocity will depend on the plasma density and temperature, including the effects of fusion products such as 3.5-MeV alphas, the shapes of these profiles, and the effectiveness of fueling the center of the plasma by radial diffusion. Under MARS conditions, the velocity requirement for frozen DT pellets will range from 4 to 20 km/s. To minimize this requirement, we will inject the pellets near the end of the central cell where the plasma radius is reduced by the strong magnetic field and where trapped alphas can be avoided by design of the magnetic field. To meet these fueling objectives, we are looking for new technologies for increasing the pellet speeds. One technology under consideration is the railgun for high-speed acceleration.

7050 **(UCRL—89260) Progress on axicell MFTF-B superconducting magnet systems.** Wang, S.T.; Kozman, T.A.; Hanson, C.L.; Shimer, D.W.; VanSant, J.H.; Zbasnik, J. (Lawrence Livermore National Lab., CA (USA)). 14 Nov 1983. Contract W-7405-ENG-48. 7p. (CONF-831203—15). NTIS, PC A02/MF A01. Order Number DE84003731.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Since the entire Mirror Fusion Test Facility (MFTF-B) Magnet System was reconfigured from the original A-cell to an axicell design, much progress has been made on the design, fabrication, and installation planning. The axicell MFTF-B magnet array consists of a total of 26 large superconducting main coils. This paper provides an engineering overview of the progress of these coils. Recent studies on the effects of field errors on the plasma at the recircularizing region (transition coils) show that small field errors will generate large displacements of the field lines. These field errors might enhance radial electron heat transport and deteriorate the plasma confinement. Therefore, 16 superconducting trim coils have been designed to correct the coil misalignments. Progress of the trim coils are reported also.

7051 **(UCRL—89271) Construction techniques for short iron-free dipole magnets.** Harvey, A.R. (Lawrence Livermore National Lab., CA (USA)). 8 Nov 1983. Contract W-7405-ENG-48. 6p. (CONF-831203—5). NTIS, PC A02/MF A01. Order Number DE84003241.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

A method was developed for economically fabricating short, wire-wound, steering magnets with maximum length, cosine-distributed, axial elements. This method utilizes multifunctional tooling to precisely flat-wind two-layer dipole halves that are subsequently reformed and encapsulated into semicylindrical form with confinement of the end turns into thin, half discs normal to the magnet axis. This paper addresses the magnet fabrication in detail, highlighting the inherent quality control features of the tooling, overall construction costs, and contemplated manufacturing enhancements.

7052 **(UCRL—89273) Mechanical and thermal design of the Cascade reactor.** Pitts, J.H. (Lawrence Livermore National Lab., CA (USA)). 1983. Contract W-7405-ENG-48. 7p. (CONF-831203—22). NTIS, PC A02/MF A01. Order Number DE84003750.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

We present an improved Cascade fusion reaction chamber that is optimized with respect to chamber radius, wall thickness, and pebble blanket outlet temperature. We show results of a parameter study where we varied chamber radius from 3 to 6 m, wall thickness from 15 to 80 mm, and blanket outlet temperature from 900 to 1400 K. Based on these studies, we achieved an optimized chamber with 50% the volume of the original design and 60% of its blanket. Chamber radius is only 4.4 m and its half length is only 5.9 m, decreased from the original 5-m radius and 8-m half-length. In our optimization method, we calculate both thermal and mechanical stresses resulting from x-ray, fusion-pellet-debris, and neutron-generated momentum, pressure from ablated material, centrifugal action, vacuum inside the chamber, and gravity. We add the mechanical stresses to thermal stresses and keep the total less than the yield stress. Further, we require that fluctuations in these stresses be less than that which would produce creep-fatigue failure within the chamber 30-year lifetime.

7053 **(UCRL—89320) Optimized baffle and aperture placement in neutral beamlines.** Stone, R.; Duffy, T.; Vetrovec, J. (Lawrence Livermore National Lab., CA (USA); TRW, Inc., Redondo Beach, CA (USA)). 23 Nov 1983. Contract W-7405-ENG-48. 6p. (CONF-831203—31). NTIS, PC A02/MF A01. Order Number DE84003746.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Most neutral beamlines contain an iron-core ion-bending magnet that requires shielding between the end of the neutralizer and this magnet. This shielding allows the gas pressure to drop prior to the beam entering the magnet and therefore reduces beam losses in this drift region. We have found that the beam losses can be reduced even further by eliminating the iron-core magnet and the magnetic shielding altogether. The required bending field can be supplied by current coils without the iron poles. In addition, placement of the baffles and apertures can affect the cold gas entering the plasma region and the losses in the neutral beam due to reionization. In our study we varied the placement of the baffles, which determine the amount of pumping in each chamber, and the apertures, which determine the beam loss. Our results indicate that a baffle/aperture configuration can be set for either minimum cold gas into the plasma region or minimum beam losses, but not both.

7054 **(UCRL—89435) Electrical energy and cost for the Mirror Fusion Test Facility.** Pence, G.A. (Lawrence Livermore National Lab., CA (USA)). 1983. Contract W-7405-ENG-48. 8p. (CONF-831203—14). NTIS, PC A02/MF A01. Order Number DE84003745.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

An operational scenario has been developed for the Mirror Fusion Test Facility (MFTF-B) based on the System Requirements, our experience with existing systems, and discussions with the project engineers and designers who are responsible for the systems. This scenario was used to predict the amount of electrical energy needed for running the facility. A generic type listing is included for the equipment considered in each system.

7055 **(UCRL—89448) Thresholds of Raman backscatter: effects of collisions and Landau damping.** Estabrook, K.; Kruer, W.L. (Lawrence Livermore National Lab., CA (USA)). 3 Nov 1983. Contract W-7405-ENG-48. 17p. (CONF-831105—4). NTIS, PC A02/MF A01. Order Number DE84003736.

From Meeting of the Plasma Physics Division of the American Physical Society; Los Angeles, CA, USA (7 Nov 1983).

We present 1.5 dimensional simulations and theory of the threshold of Raman backscatter for a variety of density profiles, background temperatures and collision frequencies, nu/sub ei/. The simulations show Raman backscatter of $\sim 4 \times 10^{-4}$ at intensities $\sim$ 30 times below the del n threshold which we suggest is due to light scattering off of noise electron plasma waves. The absorption drops significantly and the threshold rises as the Landau damping ω/sub i/ and/or nu/sub ei/ approach the growth rate γ_0. Many experiments are already in the collisional regime.

7056 **(UCRL—89471) Comparisons of hydrodynamic beam models with kinetic treatments.** Boyd, J.K.; Mark, J.W.; Sharp, W.M.; Yu, S.S. (Lawrence Livermore National Lab., CA (USA)). 6 Oct 1983. Contract W-7405-ENG-48. 14p. (CONF-830911—35). NTIS, PC A02/MF A01. Order Number DE84003242.

From 5. international conference on high power particle beams; San Francisco, CA, USA (12 Sep 1983).

Hydrodynamic models have been derived by Mark and Yu and by others to describe energetic self-pinched beams, such as those used in ion-beam fusion. The closure of the Mark-Yu model is obtained with adiabatic assumptions mathematically analogous to those of Chew, Goldberger, and Low for MHD. The other models treated here use an ideal gas closure and a closure by Newcomb

based on an expansion in V/sub th//V/sub z/. Features of these hydrodynamic beam models are compared with a kinetic treatment.

7057 **(UCRL—89521) Drift-pump coil design for a tandem mirror reactor.** Logan, B.G.; Neef, W.S. (Lawrence Livermore National Lab., CA (USA)). 1 Dec 1983. Contract W-7405-ENG-48. 9p. (CONF-831203—18). NTIS, PC A02/MF A01. Order Number DE84003749.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

This paper describes both the theory and mechanical design behind a new concept for trapped ion removal from tandem mirror end plugs. The design has been developed for the Mirror Advanced Reactor Study (MARS). The new drift-pump coils replace charge-exchange pump beams. Pump beams consume large amounts of power and seriously reduce reactor performance. Drift-pump coils consume only a few megawatts of power and introduce no added burden to the reactor vacuum pumps. In addition, they are easy to replace. The coils are similar in shape to a paper clip and are located at two positions in each end plug. The coils between the transition coil and the first anchor yin-yang serve to remove ions trapped in the magnetic well just outboard of the high field choke coil. The coils located between the anchor coil set and the plug coil set remove sloshing ions and trapped cold ions from the plug region.

7058 **(UCRL—89908) Superconducting magnetic shields for neutral beam injectors.** Fink, J.H. (Lawrence Livermore National Lab., CA (USA)). 11 Nov 1983. Contract W-7405-ENG-48. 5p. (CONF-831203—24). NTIS, PC A02/MF A01. Order Number DE84003240.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Magnetic shields made of soft magnetic materials are effective when shielding comparatively small areas from relatively weak external fields. However, to exclude higher fields from larger areas, superconducting magnetic shields are required. This paper describes an advanced concept for an intrinsically stable, type II superconducting shield made of multiple layers of thin sheets of niobium-titanium. The design presents significant engineering problems. Some of these are discussed.

7059 **Model of positive ion sources for neutral beam injection.** Chan, C.F.; Burrell, C.F.; Cooper, W.S. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Applied Physics;* **54**: No. 11, 6119-6137(Nov 1983). Contract AC03-76SF00098.

A comprehensive model is presented to describe the physics of positive ion sources used to generate hydrogen isotope neutral beams for the heating of confined plasma in magnetic fusion energy programs. The model considers 11 important atomic and molecular reactions. A set of particle balance equations, together with those for the primary and secondary electrons in the sources, are solved simultaneously. Taking as input the source geometry, gas inlet flow rate, arc current and voltage, as well as the wall recombination coefficient and the measured temperatures of neutral atoms and molecules, the model gives as output the following information: the ion current densities available for extraction, primary electron density and energy distribution, and secondary electron density and temperature. These calculated results are compared with data of several Lawrence Berkeley Laboratory ion sources, both conventional and magnetic bucket types. Exploratory calculations are made for sources of different proposed designs with the aim of improving the source performance.

7060 **Engineering aspects of particle beam fusion systems.** Cook, D.L. (Sandia National Laboratories, Albuquerque, NM). *American Society of Mechanical Engineers, [Paper];* **82-WA/NE-4**: 8(1982). (CONF-821101—).

From ASME winter annual meeting (Engineering applications of laser velocimetry/published in ASME Jr. Fluid Engineering); Phoenix, AZ, USA (14 Nov 1982).

The Department of Energy is supporting research directed toward demonstration of DT fuel ignition in an Inertial Confinement Fusion (ICF) capsule. As part of the ICF effort, two major Particle Beam Fusion Accelerators (PBFA I and II) are being developed at Sandia National Laboratories with the objective of providing energetic light ion beams of sufficient power density for target implosion. Supporting light ion beam research is being performed at the Naval Research Laboratory and at Cornell University. If the answers to several key physics and engineering questions are favorable, pulsed power accelerators will be able to provide an efficient and inexpensive approach to high target gain and eventual power production applications.

99 GENERAL AND MISCELLANEOUS

9901 Management

REFER ALSO TO CITATION(S) 7078

7061 **(DOE/EI/02295—69-Vol.2) Assessment of educational research capabilities at selected minority institutions. Volume 2.** Jones, W.J. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Jul 1983. Contract AM01-76EI02295. 314p. NTIS MF A01. Order Number DE84002129.

Microfiche only, copy does not permit paper copy reproduction.

Appendixes are presented listing abbreviations, land-grant institutions, minority institutions and locations, presidents of the institutions, and reprints of articles, letters, and directories.

7062 **(DOE/ER—0184) Guide for the preparation of applications for the University Research Instrumentation Program, 1984.** (USDOE Office of Energy Research, Washington, DC). 1984. 30p. NTIS, PC A03/MF A01. Order Number DE84003723.

The Department of Energy (DOE) announces a new program initiative intended to provide support to universities and colleges for the acquisition of sophisticated state-of-the-art scientific instruments required for advanced energy research carried out by university scientists. The University Research Instrumentation (URI) program has been developed as part of an interagency effort to help decrease the overall shortage (estimated to exceed one billion dollars) of such research equipment in universities. The appropriation recommended for this program by Congress has been set at $4,000,000 and is available in FY 1984. The $4,000,000 allocated for the University Research Instrumentation program will enable the Department to make from 8 to 15 awards. The awards will be for instruments costing in excess of above $100,000. In FY 1984 URI funds will be used principally to meet the needs of established research groups with demonstrated capability in one of four energy areas (see Section II). The selected research areas must be supported at least in part by DOE. Furthermore, the Department will consider only requests for the larger instruments or instrumentation systems (items costing about $100,000 or more), which are required to advance research in the designated area. The overall objective of this program is to assist universities and colleges in strengthening their capabilities to conduct long-range research in specific energy research and development areas of interest to DOE through the acquisition of specialized research instrumentation.

7063 **(DOE/OR/00033—T35) University programs and facilities in nuclear science and engineering. Sixth edition.** (Oak Ridge Associated Universities, Inc., TN (USA)). Jun 1982. Contract AC05-76OR00033. 156p. NTIS, PC A08/MF A01. Order Number DE84003854.

This document is to serve the needs of the academic community, government, and industry for current information regarding the status of educational training in nuclear and nuclear-related fields. Detailed descriptions are presented of nuclear programs and facilities at universities, colleges, community colleges, and technical schools. Information was compiled from questionaries completed in the fall of 1981. Section 1 summarizes degrees offered and appointments available to graduate students in nuclear fields, describes any special programs and facilities, and specifies individuals to be contacted at each institution for further information. Section 2 lists all undergraduate and graduate courses in nuclear and nuclear-related fields. Section 3 provides a tabular listing of facilities and equipment available at each institution.

7064 (LA—9800-MS) Publications of Los Alamos Research 1982. McClary, W.J.; Rodriguez, L.L.; Sheridan, C.J. (comps.). (Los Alamos National Lab., NM (USA)). Oct 1983. Contract W-7405-ENG-36. 153p. NTIS, PC E08/MF $6.75. Order Number DE84003557.

Includes 14 sheets of 24x reduction microfiche.

This bibliography is a compilation of unclassified publications of work done at the Los Alamos National Laboratory for 1982. Papers published in 1982 are included regardless of when they were actually written. Publications received too late for inclusion in earlier compilations have also been listed. Declassfiication of previously classified reports is considered to constitute publication. All classified issuances are omitted - even those papers, themselves unclassified, which were published only as part of a classified document. If a paper was published more than once, all places of publication are included. The bibliography includes Los Alamos National Laboratory reports, papers released as non-Laboratory reports, journal articles, books, chapters of books, conference papers either published separately or as part of conference proceedings issued as books or reports, papers published in congressional hearings, theses, and US patents. Publications by Los Alamos authors that are not records of Laboratory-sponsored work are included when the Library becomes aware of them.

7065 (LA-UR—83-3340) Comparison of FMS versus TDMS applications. Werner, N.E. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 31p. (CONF-8310182—12). NTIS, PC A03/MF A01. Order Number DE84003796.

From US fall DECUS symposium; Las Vegas, NV, USA (24 Oct 1983).

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A business application which uses forms management is described. The screen format, data dictionary, dataflow diagrams, minispecs, and structured design chart are included to provide the description of this application. It is implemented using TDMS and FMS in separate applications. Examples of code are included showing both methods of implementation. Finally, a comparison of FMS features and TDMS features is done, indicating that the nature of the application and also the environment under which the application will be used and maintained dictates which form product would be more suitable.

7066 (UCID—19905) Student reports on summer 1982 work under OEO sponsorship for the LLNL Earth Sciences Department. Doyle, M.C.; Griffith, P.J.; Holbert, K.F. II; Swecker, J.L.; Tewes, H.A. (Lawrence Livermore National Lab., CA (USA)). 12 Oct 1983. Contract W-7405-ENG-48. 62p. NTIS, PC A04/MF A01. Order Number DE84003514.

A number of research programs were successfully completed during the summer of 1982 by students sponsored by the Office of Equal Opportunity at the Lawrence Livermore National Laboratory. These students were working with scientists in the Earth Sciences Department. Accomplishments include the following: interpretation of refraction data from a seismic line at the Nevada Test Site; logging of water sampling wells at Site 300 and assisting with well completion procedures; preparation of a bibliography on Darcy's law and the flow of fluids through porous media; and investigation of mass transfer phenomenology in packed beds of oil shale.

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 5679, 5811, 6781, 6962, 6970

7067 (ANL/MCS-TM—9) Squeezing the most out of an algorithm in Cray Fortran. Dongarra, J.J.; Eisenstat, S.C. (Argonne National Lab., IL (USA)). May 1983. Contract W-31-109-ENG-38. 18p. NTIS, PC A02/MF A01. Order Number DE84003871.

This paper discusses a technique for achieving supervector performance on a Cray in a purely Fortran environment (i.e., without resorting to assembly language). The technique can be applied to a wide variety of algorithms in linear algebra, and is beneficial in other architectural settings.

7068 (CONF-8309185—1) Fourier-Motzkin elimination as a technique for error localization. Liepins, G.E. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 10p. NTIS, PC A02/MF A01. Order Number DE84003309.

From 19. annual meeting of the Southeastern Chapter of the Institute of Management Sciences; Myrtle Beach, SC, USA (29 Sep 1983).

The minimum weighted fields to impute (MWFI) problem of automatic data editing is disclosed and defined. Five types of solution algorithms are discussed: general fixed charge, node-disconnect, branch and bound, Chernikova, linear programming based sequential, and Fourier-Motzkin based sequential. The latter (Fourier-Motzkin based sequential) is illustrated with an example.

7069 (DOE/ER/03077—204) Problems solved and unsolved concerning linear and nonlinear partial differential equations. Lax, P.D. (New York Univ., NY (USA). Courant Mathematics and Computing Lab.). Nov 1983. Contract AC02-76ER03077. 32p. NTIS, PC A03/MF A01. Order Number DE84004990.

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Current research in partial differential equations is extensive, varied and deep. A single lecture, if it is not to be a mere catalogue, can present only a partial list of recent achievements, some comments on the modern style, i.e., the kinds of problems chosen and methods used for solution, and cautions speculations on future trends. The choice of examples is of course shaped by the personal taste of the speaker and limited by his expertise. The first part of this lecture is such an overview; it is followed by a more detailed discussion of two topics with which the speaker has some familiarity, one concerning a linear, the other a nonlinear problem in partial differential equations.

7070 (K/CSD/TM—43) ARIES: a computer program for the solution of first kind integral equations with noisy data. Drake, J.B. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Oct 1983. Contract W-7405-ENG-26. 61p. NTIS, PC A04/MF A01. Order Number DE84003908.

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The method of regularization using a weighted Sobolev norm is developed and applied for the numerical solution of first kind integral equations with noisy data. The algorithm and computer program described in this report are based on the singular value decomposition (SVD) of the discretized least squares functional. The method of cross validation is developed for choosing the regularization parameter and its relationship to the SVD is described. Some example problems are included to give the reader a feel for the delicacy of ill-posed problems. They include finding the first and second derivatives of functions given by data that are noisy and solving an inverse heat conduction problem.

7071 (ORNL/CSD/TM—163) Mapper user's manual. Clark, B.A.; Fischer, K.N.; Nestor, C.W.; Penny, S.K.; Dahl, D.A. (Oak Ridge National Lab., TN (USA)). Nov 1983. Contract W-7405-ENG-26. 366p. NTIS, PC A16/MF A01. Order Number DE84003478.

MAPPER is a front-end program for DISSPLA from Los Alamos Scientific Laboratory. This Manual is a copy of LASL Program Library Write-Up J5AJ which has been revised to be consistent with the version of MAPPER installed at Oak Ridge National Laboratory. MAPPER is an easy-to-learn program designed to make report-quality visual aids. The user with no previous programming experience can produce presentation slides, graphs, charts, tables, and maps on both color and black and white 35-mm microfilm, Tektronix terminals, and Versatec, Applicon and CalComp plotters. MAPPER can also be used to make 35- and 16-mm color or black and white movies. MAPPER reads English language based command files that the user has generated. An interactive editor, MAPEDIT, allows Tektronix users to add features on the scope and to have the additions automatically added to the command file. A Tektronix Graphics Tablet can be used to generate MAPPER command files directly via TABLET. MAPPER can draw boxes, circles, ellipses, and complex line segments in a wide variety of line format characteristics. There are six types of label

commands and twelve lettering styles to cover the spectrum of labeling requirements. Label options include manual sizing and locations, two forms of automatic sizing and location, flexible string control, label rotation, justification control, and multiple line capabilities. The user has a choice of color control through the use of different commands, and special features permit selective shading of specific areas. Symbols may be defined, located, scaled, distorted, and shaded as desired. Axes, curves and error bars may be drawn. Additional features include various logos, skipping, multilevel rotating projection ports, contouring, three types of file subroutining, movie generating commands, and FORTRAN support capabilities.

7072 **(SAND—83-0882C) L_2-projection for transferring data between finite element meshes.** Chavez, P.F. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 7p. (CONF-840119—1). NTIS, PC A02/MF A01. Order Number DE84000063.

From 5. international symposium on finite element methods in flow problems; Austin, TX, USA (23 Jan 1984).

This paper examines the L_2-projection method for transferring data between different finite element function spaces. Theoretical results are presented which indicate that the L_2-projection conserves momentum and energy almost optimally during the transferral process for constant mass density systems. The general formulation of the L_2-projection method for any given mesh data in any number of spatial dimensions or for any finite element spaces is presented.

7073 **(SAND—83-1052) POSADI: a post processor for ADINA.** Richgels, M. (Sandia National Labs., Albuquerque, NM (USA)). May 1983. Contract AC04-76DP00789. 49p. NTIS, PC A03/MF A01. Order Number DE84003368.

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POSADI is a post processing program for the ADINA finite element code. The output files generated by ADINA are translated by POSADI to a standardized plotting data format. This new format can be used as input to various plotting programs such as TPLOT2 (2), SPLOT (7), and MOVIE.BYU (6). Since the plotting codes plot with 4 node two dimensional (2D) elements and 8 node three dimensional (3D) elements, POSADI transforms the 8 node 2D element to four 4 node elements and the 20 node 3D element to eight 8 node elements. For 2D and 3D problems, all element data are interpolated to the nodes.

7074 **(UCID—19937) Matrix-free methods in the solution of stiff systems of ODE's.** Brown, P.N.; Hindmarsh, A.C. (Lawrence Livermore National Lab., CA (USA)). Nov 1983. Contract W-7405-ENG-48. 36p. NTIS, PC A03/MF A01. Order Number DE84003361.

This is an informal preliminary report, on a study of a matrix-free method for solving stiff systems of ordinary differential equations (ODE's). In the numerical time integration of stiff ODE initial value problems by BDF methods, the resulting nonlinear algebraic system is usually solved by a modified Newton method and an appropriate linear sytem algorithm. In place of that, we substitute Newton's method (unmodified) coupled with an iterative linear system method. The latter is a projection method called the Incomplete Orthogonalization Method (IOM), developed mainly by Y. Saad. A form of IOM, with scaling included to enhance robustness, is studied in the setting of Inexact Newton Methods, and implemented in a way that requires no matrix storage whatever. Tests on several stiff problems, of sizes up to 5000, show the method to be quite effective, and much more economical, in both computational cost and storage, than standard solution methods.

7075 **(UCID—19940) Use of the Bernstein form to derive sufficient conditions for shape preserving piecewise polynomial interpolation.** Fritsch, F.N. (Lawrence Livermore National Lab., CA (USA)). Nov 1983. Contract W-7405-ENG-48. 15p. NTIS, PC A02/MF A01. Order Number DE84003914.

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The Bernstein form for the degree 2K-1 polynomial pieces of an Hermite spline can be used to derive sufficient conditions for shape preserving interpolation. These conditions are worked out in detail for the linear, cubic, and quintic cases.

7076 **(UIUCDCS-R—83-1121) Algorithm for the detection and integration of highly oscillatory ordinary differential equations using a generalized unified modified divided difference representation.** Gallivan, K.A. (Illinois Univ., Urbana (USA). Dept. of Computer Science). Jun 1983. Contract AC02-76ER02383. 117p. (UILU-ENG—83-1712; COO—2383-0093). NTIS, PC A06/MF A01. Order Number DE84003585.

The generalized Adams and generalized BDF methods for the integration of highly oscillatory ordinary differential equations are derived as natural variable step predictor-corrector pairs. The unified modified divided difference representation is generalized for use in representing the natural variable step formulae.

9903 Information Handling

REFER ALSO TO CITATION(S) 5781, 7071

7077 **(CONF-831117—1) Locating machine-readable data files.** Olson, R.J. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 15p. NTIS, PC A02/MF A01. Order Number DE84003389.

From 4. integrated data users workshop; Reston, VA, USA (1 Nov 1983).

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More machine-readable data files (MRDFs) are being produced now than in the past by federal agencies specifically for public dissemination or as by-products of research and statistical report compilations. It is imperative that maximum use be made of existing data resources. Directories and clearinghouses of MRDFs, especially those maintained as updated, searchable databases, are available in many agencies to asisst users in locating and acquiring data files. However, there is a great variety among agencies in providing this service. Currently automated directory systems exist which utilize bibliographic based systems and, in addition, a proposed voluntary standard is available for use in describing MRDFs. To maximize the use of MRDFs, all agencies need to develop and maintain a directory of MRDFs. Some specific clearinghouses, directories, and agency sources of information are listed.

7078 **(DOE/BC/10474—1) Project Tracking System (PTS). User's manual and program documentation.** (Advanced Technology, Inc., McLean, VA (USA)). Nov 1983. Contract AC19-81BC10474. 359p. NTIS, PC A16/MF A01. Order Number DE84004855.

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The Bartlesville Energy Technology Center (BETC) Project Tracking System (PTS) is a computerized information system developed to generate automatic updates to other Department of Energy (DOE) systems such as the Business Management Information System (BMIS), as well as to aid in the in-house tracking of the cost, schedule, and manpower status of the approximately 200 BETC contracts. The PTS data base contains administrative and limited technical information on planned, active, and terminated contracts. The PTS software and data base are resident upon BETC's PDP 11/70 computer, which utilizes the RSX-11M operating system. PTS programming was done in the BASIC + II and DATATRIEVE languages, which allow for conversational, English-like interactions between the user and the system during both input and output sessions.

9905 Civilian Defense

7079 **(INIS-mf—8237) Activities of the Civil Defense Commission of the Federal Ministry of the Interior. Annual report 1979. Vol. 1.** (Strahlenschutzkommission, Koeln (Germany, F.R.); Bundesamt fuer Zivilschutz, Bonn (Germany, F.R.)). 1979. 283p. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83704630.

The various working groups of the Committees I-III of the Commission report on the protective efficiency of buildings (shelters, crack formation, fire hazards), on the basic decisions to be taken in cases emergency, i.e. on the selection of appropriate provisions to be made for the protection of the population against hazards resulting from radioactive pollution of waters and air (civil defense) or from radiation exposure due to radioactive airborne particles and radioactive iodine, on radiation effects and the reduction of radiation impacts by specific substances, as well as on biological dosimetry in disaster relief.

7080 **(INIS-mf—8261) Activities of the Civil Defense Commission of the Federal Ministry of the Interior. Annual report 1979.** (Strahlenschutzkommission, Koeln (Germany, F.R.)). 1979. 307p. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780039.

Individual items in scope for the data base are processed separately.

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In the Corporate Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

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DOE Energy Information Data Base: Corporate Author Entries (DOE/TIC-4585) is used in the standardization of corporate entries. DOE/TIC-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.

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The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processses applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed. Copies of DOE/TIC-7000, the Subject Thesaurus, are available from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, VA 22161.

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AC13-76GJ01664	**Bendix Field Engineering Corp., Grand Junction, CO (USA)**	
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AC13-82GJ01706	**Oklahoma Univ., Norman (USA). Energy Resources Inst.**	
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AC15-76CL50003	**Westinghouse Electric Corp., Madison, PA (USA). Advanced Energy Systems Div.**	
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AC19-81BC10474	**Advanced Technology, Inc., McLean, VA (USA)**	
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AC21-79MC10689	**New Mexico Inst. of Mining and Technology, Socorro (USA). New Mexico Petroleum Recovery Research Center**	
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AC21-80ET14928	**General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.**	
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AC22-76ET10495	**Montana State Univ., Bozeman (USA). Dept. of Chemical Engineering**	
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AC22-80PC30013	**Pennsylvania State Univ., University Park (USA). Coal Research Section**	
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AC22-80PC30080	**Gulf Research and Development Company, P.O. Drawer 2038, Pittsburgh, PA 15230**	
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AC22-81PC30019	**Air Products and Chemicals, Inc., Allentown, PA (USA)**	
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AC22-82PC51006	**Drexel Univ., Philadelphia, PA (USA). Coll. of Engineering**	
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AI01-81ER60001	**North Carolina State Univ., Raleigh**	
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AM03-76SF00010	**Department of Physics, University of California, Los Angeles, California 90024**	
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AS05-76ER02408	**Duke Univ., Durham, NC (USA)**	
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AS05-76ER03956	**Tennessee Univ., Knoxville (USA)**	
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AS05-76ER04447	**Tennessee Univ., Knoxville (USA). Dept. of Chemistry**	
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AS05-76ER05223	**Virginia Univ., Charlottesville (USA). Dept. of Physics**	
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AS05-79ER10419	**Florida State Univ., Tallahassee (USA). Dept. of Physics**	
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AS05-80ER10666	**Univ. of Maryland, College Park, Maryland 20742**	
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AS05-81ER40008	**Physics Department, University of Florida, Gainesville, Florida 32611**	
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AS05-82ER40074	**Department of Physics and Astronomy, University of Kentucky, Lexington, Kentucky 40506**	
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AS19-78BC20002	**Minnesota Univ., Minneapolis (USA). Dept. of Chemical Engineering and Materials Science**	
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AS19-81BC10640	**Colorado State Univ., Fort Collins (USA). Dept. of Physics**	
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AT03-76ER70058	**Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.**	
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AT03-76ER70068	**Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.**	
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AT03-76ER70217	**California Univ., Irvine (USA). Dept. of Chemistry**	
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AT03-76ER72018	**Stanford Univ., CA (USA). Systems Optimization Lab.**	
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AT03-76ET51011	**GA Technologies, Inc., San Diego, CA (USA)**	
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AT03-76ET53023	**California Univ., San Diego, La Jolla (USA). Dept. of Physics**	
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AT03-76EV70032	**Stanford Univ., CA (USA). Dept. of Pathology**	
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AT03-80ER10700	**California Univ., Davis (USA)**	
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AT03-82SF11687	**Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group**	
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FC03-77CS31509	**Spearfish School District, SD (USA)**	
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FC03-77SF10501	**Natural History Museum Foundation, Los Angeles, CA (USA). Section of Ornithology**	
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	Southern California Edison Co., Rosemead (USA)	
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FC03-78CS32150	**Lightowler Johnson Associates, Inc., Fargo, ND (USA)**	
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FG01-77ET10657	**Department of Chemical Engineering, University of Arizona, Tucson, AZ 85721**	
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FG01-80ET21099	**Puerto Rico Electric Power Authority, San Juan**	
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FG01-81CS15041	**Fluid Coal Corp., Wilmington, DE (USA)**	
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FG01-83ER60144	**American Coll. of Nuclear Physicians, Washington, DC**	
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FG02-80CS84063	**Department of Chemistry, University of Virginia, Charlottesville, Virginia 22901**	
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FG02-81WM46642	**Vermont Agency of Environmental Conservation, Montpelier (USA)**	
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FG02-82ER60057	**Johns Hopkins Univ., Baltimore, MD (USA). School of Hygiene and Public Health**	
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FG05-81OR20808	**Renewable Energy, Inc., Paducah, KY (USA)**	
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FG05-82ER40058	**Virginia Univ., Charlottesville (USA). Dept. of Physics**	
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FG06-77ET20181	**Univ. of Alaska, Fairbanks**	
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FG07-81ID12221	**Kearney (A.T.), Inc., Alexandria, VA (USA)**	
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FG22-80PC30199	**Department of Mineral Engineering and Fuel Science Section, The Pennsylvania State University, Unive**	
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FG22-80PC30212	**Washington State Univ., Pullman (USA). Dept. of Mechanical Engineering**	
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FG22-80PC30215	**Massachusetts Inst. of Tech., Cambridge (USA)**	
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FG22-80PC30305	**Department of Aerospace Engineering, The University of Michigan, Ann Arbor, Michigan 48109**	
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FG22-81PC40780	**Department of Chemistry, Purdue University, West Lafayette, IN 47907**	
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FG22-81PC40809	**Brigham Young Univ., Provo, UT (USA). Dept. of Chemistry**	
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FG22-82PC50797	**California Univ., Riverside (USA)**	
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FG22-83PC60804	**Oklahoma Univ., Norman (USA). School of Chemical Engineering and Materials Science**	
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FG46-79R610952	**Caskey (David L.), Albuquerque, NM (USA)**	
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FG46-79R610963	**Campbell (James R.), Carrollton, TX (USA)**	
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FG46-79R610967	**Feller (Dennis Werner), Fredericksburg, TX (USA)**	
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FG46-79R610970	**Sunshine Insulation, Albuquerque, NM (USA)**	
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FG46-79R610995	**Center for the Study of Human Adaptation, Austin, TX (USA)**	
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FG46-80R611995	**ARK-o-hol Community Experiment Group, Scranton, AR (USA)**	
	9:5836	DOE/R6/11995—T1
FG46-80R611996	**Upham (Russell W.), Bella Vista, AR (USA)**	
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FG46-80R611998	**Environmental Technical Consultants, Inc., Little Rock, AR (USA)**	
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FG46-80R611999	**Arkansas State Government, Little Rock (USA)**	
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FG46-80R612002	**Barron, Heinberg and Brocato, Alexandria, LA (USA)**	
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FG46-80R612007	**Woodhouse (Robert P.), Slidell, LA (USA)**	
	9:5874	DOE/R6/12007—T1
FG46-80R612016	**Price (Michael), Socorro, NM (USA)**	
	9:5859	DOE/R6/12016—T1
FG46-80R612021	**Shelton Energy Research, Santa Fe, NM (USA)**	
	9:6390	DOE/R6/12021—T1
FG46-80R612056	**Richards (William H.), Silsbee, TX (USA)**	
	9:6102	DOE/R6/12056—T1
FG46-81AF92502	**Delta Solar Systems, Blytheville, AR (USA)**	
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FG46-81R612013	**Hair (Michael), Lafayette, LA (USA)**	
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FG46-81R612034	**Reed (Leighton B.), Kansas, OK (USA)**	
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FG46-81R612068	**Keel (James S.), Harrison, AR (USA)**	
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FG46-81R612072	**ARK-o-hol Community Experiment Group, Scranton, AR (USA)**	
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FG46-81R612086	**Wayland Baptist Univ., Plainview, TX (USA)**	
	9:5829	DOE/R6/12086—T1
FG46-81R612332	**Peanut Butter and Jelly Therapeutic Pre-School, Albuquerque, NM (USA)**	
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NAS-7-100-954739	**Rockwell International Corp., Thousand Oaks, CA (USA). Science Center**	
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NAS-7-100-955533	**Hemlock Semiconductor Corp., MI (USA)**	
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	IEEE Trans. Nucl. Sci., NS-30: No. 4, 3666-3668(Aug 1983)			9:6511
	IEEE Trans. Nucl. Sci., NS-30: No. 4, 2763-2768(Aug 1983)			9:6512
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	IEEE Trans. Nucl. Sci., NS-30: No. 4, 2847-2849(Aug 1983)			9:6535
	IEEE Trans. Nucl. Sci., NS-30: No. 4, 2892-2894(Aug 1983)			9:6536
	IEEE Trans. Nucl. Sci., NS-30: No. 4, 2914(Aug 1983)			9:6537
	IEEE Trans. Nucl. Sci., NS-30: No. 4, 3387-3389(Aug 1983)			9:6538
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	IEEE Trans. Nucl. Sci., NS-30: No. 4, 3505-3507(Aug 1983)			9:6540
	IEEE Trans. Nucl. Sci., NS-30: No. 4, 3545-3547(Aug 1983)			9:6541
	IEEE Trans. Nucl. Sci., NS-30: No. 4, 3548-3550(Aug 1983)			9:6542
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	IEEE Trans. Nucl. Sci., NS-30: No. 4, 2373-2377(Aug 1983)			9:6550
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	IEEE Trans. Nucl. Sci., NS-30: No. 4, 2290-2292(Aug 1983)			9:6552
193 CONF-830392-	NTIS, PC A02/MF A01; 1 (Spring meeting for extraterrestrial physics of the Astronomische Gesellschaft and Constance symposium on cosmology and relativistic astrophy, Konstanz, F.R. Germany, 22-25 Mar 1983)	DE84003601	MN -28	9:6411
No.58 CONF-8303110-	Bochum Univ. (Germany, F.R.). Astronomisches Inst. (4. capacitor and resistor technology symposium, Orlando, FL, USA, 6-8 Mar 1983)			9:6751
1	*See* SAND-83-1668C	DE84003762	MN -38	9:6387

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CONF-830444-	(International school-seminar on heavy ion physics, Alushta, USSR, 14-21 Apr 1983)			
4	*See* INIS-mf-8671	DE84700525	MN -34C	9:6934
CONF-830455-	(Yamada conference on muon spin rotation and associated problems, Shimoda, Japan, 18-27 Apr 1983)			
10	*See* LBL-16291	DE84002905	MN -34D	9:6948
CONF-830508-	(163. Electrochemical Society meeting, San Francisco, CA, USA, 8-13 May 1983)			
27	*See* LBL-16522	DE84004961	MN -94cc	9:5985
CONF-830528-	(7. international symposium on packaging and transportation of radioactive materials, New Orleans, LA, USA, 15-20 May 1983)			
62	NTIS, PC A02/MF A01	DE84003289	MN -71	9:5781
CONF-830556-	(International workshop on the principles of environmental mutagenesis, carcinogenesis, and teratogenesis, Shanghai, China, 25 May-1 Jun 1983)			
3	NTIS, PC A04/MF A01	DE84003485	MN -48	9:6671
CONF-830573-	(2. international conference on radiation effects in insulators, Albuquerque, NM, USA, 30 May-3 Jun 1983)			
9	*See* PNL-SA-11218	DE84003206	MN -70	9:5796
CONF-830576-	(Real-time computer applications in nuclear and particle physics conference, Berkeley, CA, USA, 16-20 May 1983)			
15	NTIS, PC A02/MF A01	DE84003615	MN -28	9:6464
CONF-8305100-	(4. Electrochemical Society international symposium on molten salts, San Francisco, CA, USA, 8-13 May 1983)			
8	NTIS, PC A03/MF A01; 1	DE84003275	MN -04	9:6306
CONF-8305144-	(Jubilee meeting: 50 years of DGZfP meeting on non-destructive testing: past, present, future, Berlin, F.R. Germany, 8-12 May 1983)			
Absts.	Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe, Germany, F.R.			9:6193
CONF-830609-	(ANS annual meeting, Detroit, MI, USA, 12-17 Jun 1983)			
60	NTIS, PC A02/MF A01	DE84003196	MN -80	9:5938
61	NTIS, PC A02/MF A01	DE84003160	MN -78	9:5956
62	NTIS, PC A02/MF A01	DE84003195	MN -86	9:5807
CONF-830633-	(3. symposium on separation science and technology for energy applications, Gatlinburg, TN, USA, 27 Jun-1 Jul 1983)			
7	NTIS, PC A03/MF A01	DE84003168	MN -04	9:6265
CONF-830640-	(ASHRAE conference, Washington, DC, USA, 26-30 Jun 1983)			
10	*See* LBL-14893	DE84004966	MN -95d	9:6073
CONF-830659-	(TMS/AIME topical conference on ferritic alloys for use in nuclear energy technologies, Snowbird, UT, USA, 19-23 Jun 1983)			
16	NTIS, PC A02/MF A01	DE84003161	MN -25	9:6138
17	NTIS, PC A02/MF A01	DE84003162	MN -25	9:6139
CONF-8306121-	(4. workshop on free-electron laser devices, Eastsound, WA, USA, 27 Jun-1 Jul 1983)			
5	*See* UCRL-89215	DE84003751	MN -21	9:6365
CONF-8306144-	(Symposium on conversation in biomolecular stereodynamics III, Albany, NY, USA, 7-10 Jun 1983)			
1	NTIS, PC A02/MF A01	DE84003175	MN -48	9:6613
CONF-830706-	(13. international conference on the physics of electronic and atomic collisions (ICPEAC), Berlin, F.R. Germany, 27 Jul-2 Aug 1983)			
8	NTIS, PC A02/MF A01	DE84003265	MN -34A	9:6759
CONF-830711-	(16. American Carbon Society biennial conference, La Jolla, CA, USA, 17-22 Jul 1983)			
7	NTIS, PC A02/MF A01	DE83015695	MN -80	9:6227
CONF-830758-	(Workshop on advanced bumpy torus concepts, Rancho Santa Fe, CA, USA, 11-13 Jul 1983)			
	NTIS, PC A19/MF A01; 1	DE84002406	MN -20	9:7020
CONF-830795-	(Symposium on energy removal and particle control and toroidal fusion devices, Princeton, NJ, USA, 26-29 Jul 1983)			
5	*See* GA-A-17178	DE84003811	MN -20a	9:6988
6	NTIS, PC A03/MF A01	DE84003263	MN -20a	9:7032
CONF-830798-	(3. LAMPF II workshop, Los Alamos, NM, USA, 18-29 Jul 1983)			
6	*See* BNL-33864	DE84002856	MN -34D	9:6808
CONF-830805-	(7. international conference on structural mechanics in reactor technology, Chicago, IL, USA, 22-26 Aug 1983)			
61	NTIS, PC A02/MF A01	DE84001848	MN -79	9:6731
CONF-830812-	(18. intersociety energy conversion engineering conference, Orlando, FL, USA, 21-26 Aug 1983)			
60	*See* N-8326253			9:5986
61	Institute of Gas Technology, 3424 S State Street, ITT Center, Chicago, IL 60616; 1		MN -90c	9:5665
CONF-830815-	(18. annual Microbeam Analysis Society conference, Phoenix, AZ, USA, 8-12 Aug 1983)			
10	*See* EGG-M-06383	DE84001003	MN -78	9:5921
CONF-830816-	(International meeting on light-water reactor severe accident evaluation, Cambridge, MA, USA, 28 Aug-1 Sep 1983)			
48	*See* BNL-NUREG-33896	DE84003850	MN -78	9:5954

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CONF-830818-	(11. biennial topical conference on reactor operating experience - plant startup and operations in the 80's, Scottsdale, AZ, USA, 1-3 Aug 1983)			
7	NTIS, PC A02/MF A01	DE84003298	MN -80	9:5957
CONF-830822-	(12. international conference on high energy accelerators, Batavia, IL, USA, 11-16 Aug 1983)			
42	*See* LBL-16506	DE84002902	MN -28	9:6476
43	*See* LBL-16034	DE84003051	MN -28	9:6415
44	*See* SLAC-PUB-3227	DE84003517	MN -28	9:6400
CONF-830847-	(Energy resource management '83, San Francisco, CA, USA, 23-27 Aug 1983)			
6	NTIS, PC A03/MF A01; 1	DE84003404	MN -11	9:5935
CONF-830852-	(Measurement techniques in power engineering summer school, Dubrovnik, Yugoslavia, 29 Aug-3 Sep 1983)			
2	*See* LA-UR-83-3205	DE84003779	MN -32	9:6374
CONF-830859-	(National meeting of the American Institute of Chemical Engineers, Denver, CO, USA, 28-31 Aug 1983)			
10	*See* LBL-16785	DE84002181	MN -94c	9:5846
CONF-830888-	(5. international conference on liquid and amorphous metals, Los Angeles, CA, USA, 15-19 Aug 1983)			
11	NTIS, PC A02/MF A01	DE84003570	MN -34	9:6140
12	NTIS, PC A02/MF A01	DE84003572	MN -25	9:6141
CONF-8308100-	(91. annual meeting of the American Psychological Association, Anaheim, CA, USA, 27 Aug-2 Sep 1983)			
5	*See* PNL-SA-11599	DE84000149	MN -80	9:5977
CONF-8308115-	(US/Canadian conference on forest responses to acidic deposition, Orono, ME, USA, 3-4 Aug 1983)			
2	NTIS, PC A03/MF A01	DE84003384	MN -11	9:6583
CONF-8308126-	(NRC research annual review meeting of nuclear waste management research on geochemistry of HLW disposal, Reston, VA, USA, 30 Aug-1 Sep 1983)			
4	NTIS, PC A02/MF A01	DE84003457	MN -70	9:5805
CONF-8308136-	(Solar seismology from space conference, Snowmass, CO, USA, 17 Sep-19 Aug 1983)			
2	*See* LA-UR-83-3217	DE84003786	MN -34B	9:6740
CONF-8308141-	(Workshop on methods for assessing the effects on non-human biota of mixtures of chemicals, Guildford, Surrey, UK, 15-17 Aug 1983)			
1	NTIS, PC A03/MF A01	DE84003297	MN -11	9:6595
CONF-830901-	(Anticipated and abnormal plant transients in light water reactors conference, Jackson, WY, USA, 26-29 Sep 1983)			
11	*See* EGG-M-09383	DE84000802	MN -80	9:5962
21	*See* EGG-M-04983	DE84002892	MN -78	9:5946
CONF-830905-	(Joint power generation conference, Indianapolis, IN, USA, 25-29 Sep 1983)			
	Am. Soc. Mech. Eng., [Pap.], No. 83-JPGC-PWR-42, 8(1983)			9:5731
CONF-830908-	(11. European conference on controlled fusion and plasma physics, Aachen, F.R. Germany, 5-9 Sep 1983)			
8	NTIS, PC A02/MF A01; 1	DE84003314	MN -20g	9:7033
CONF-830909-	(Course and workshop on mirror-based and field-reversed approaches to magnetic fusion, Varenna, Italy, 7-17 Sep 1983)			
10	NTIS, PC A03/MF A01; 1	DE84003311	MN -20d	9:7034
CONF-830910-	(3. national conference on synchrotron radiation instrumentation, Upton, NY, USA, 12-14 Sep 1983)			
9	*See* LBL-16641	DE84002906	MN -28	9:6477
CONF-830911-	(5. international conference on high power particle beams, San Francisco, CA, USA, 12-14 Sep 1983)			
35	*See* UCRL-89471	DE84003242	MN -21	9:7056
36	*See* LBL-16639	DE84002911	MN -21	9:6398
37	*See* UCRL-88922	DE84003895	MN -28	9:6418
CONF-830930-	(15. ICHMT symposium on heat and mass transfer measurement techniques, Dubrovnik, Yugoslavia, 5-9 Sep 1983)			
1	NTIS, PC A03/MF A01; 1	DE84004022	MN -79m	9:5923
CONF-830942-	(3. topical meeting on fusion reactor materials, Albuquerque, NM, USA, 19-23 Sep 1983)			
21	NTIS, PC A02/MF A01	DE84000729	MN -80	9:5939
62	NTIS, PC A02/MF A01	DE84003270	MN -20c	9:6142
63	NTIS, PC A02/MF A01	DE84003382	MN -20c	9:6143
64	*See* HEDL-SA-2793-FP	DE84003790	MN -20c	9:6154
65	NTIS, PC A02/MF A01; 1	DE84003203	MN -20c	9:6144
66	NTIS, PC A02/MF A01	DE84003410	MN -20c	9:7035
67	NTIS, PC A02/MF A01	DE84003411	MN -20c	9:6145
68	*See* HEDL-SA-2897	DE84003954	MN -20c	9:6155
70	NTIS, PC A02/MF A01	DE84003266	MN -20c	9:6146
CONF-830953-	(7. international solid state dosimetry conference, Ottawa, Canada, 27-30 Sep 1983)			
1	NTIS, PC A02/MF A01	DE84003315	MN -41	9:6580
CONF-830970-	(International symposium on highly excited states and nuclear structure, Orsay, France, 5-8 Sep 1983)			
5	NTIS, PC A02/MF A01	DE84003287	MN -34D	9:6905
CONF-830971-	(8. international conference on magnet technology and exhibition, Grenoble, France, 5-9 Sep 1983)			
7	NTIS, PC A02/MF A01	DE84003165	MN -20	9:7036

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8	*See* LBL-16607	DE84002914	MN -28	9:6358
CONF-830990-	(Solar thermal research workshop, Atlanta, GA, USA, 7-8 Sep 1983)			
3	*See* SERI/TP-252-2105	DE84000019	MN -62e	9:5864
5	IGT, 3424 South State Street, IIT Center, Chicago, IL 60616		MN -62	9:5866
CONF-8309118-	(Topical meeting on free electron generation of extreme ultraviolet coherent radiation, Upton, NY, USA, 19-22 Sep 1983)			
4	*See* LA-UR-83-3288	DE84003798	MN -28	9:6475
CONF-8309130-	(14. international technical meeting on air pollution modeling and its applications, Copenhagen, Denmark, 27-30 Sep 1983)			
3	NTIS, PC A02/MF A01	DE84003569	MN -11	9:6584
CONF-8309131-	(Mineral matter in peat workshop, Los Alamos, NM, USA, 26-30 Sep 1983)			
	See LA-9907-OBES	DE84002332	STD -11	9:5700
CONF-8309144-	(EPS conference on computing in accelerator design and operation, Berlin, F.R. Germany, 20-23 Sep 1983)			
6	*See* SLAC-PUB-3218	DE84003518	MN -28	9:6479
7	*See* SLAC-PUB-3229	DE84003520	MN -28	9:6417
8	*See* SLAC-PUB-3217	DE84003519	MN -28	9:6478
CONF-8309156-	(7. meeting of the international collaboration on advanced neutron sources, Ontario, Canada, 12-16 Sep 1983)			
9	*See* TRI-PP-83-103	DE84900496	MN -28	9:6481
10	*See* TRI-PP-83-99	DE84900497	MN -28	9:6480
12	*See* LA-UR-83-3200	DE84003782	MN -34C	9:6471
13	NTIS, PC A02/MF A01	DE84003595	MN -28	9:6467
14	NTIS, PC A02/MF A01; 1	DE84003678	MN -28	9:6468
CONF-8309163-	(Conference on low energy tests of conservation laws in particle physics, Blacksburg, VA, USA, 12-14 Sep 1983)			
3	*See* LA-UR-83-3359	DE84003831	MN -34D	9:6823
CONF-8309166-	(2. international conference on carbonaceous particles in the atmosphere, Linz, Austria, 11-14 Sep 1983)			
6	NTIS, PC A02/MF A01	DE84003272	MN -90i	9:5697
7	*See* LBL-16103	DE84002926	MN -4	9:6588
CONF-8309168-	(3. international conference on ultra-relativistic nucleus-nucleus collisions, Upton, NY, USA, 26-30 Sep 1983)			
3	*See* BNL-33814	DE84002865	MN -28	9:6452
CONF-8309179-	(Annual convention of the Austrian Physical Society, Linz, Austria, 28-30 Sep 1983)			
Absts.	*See* INIS-mf-8672	DE84700519	MN -34A	9:6806
CONF-8309185-	(19. annual meeting of the Southeastern Chapter of the Institute of Management Sciences, Myrtle Beach, SC, USA, 29-30 Sep 1983)			
1	NTIS, PC A02/MF A01	DE84003309	MN -32	9:7068
CONF-831011-	(American Vacuum Society symposium, Boston, MA, USA, 31 Oct-4 Nov 1983)			
4	NTIS, PC A02/MF A01	DE84003649	MN -20f	9:6985
CONF-831012-	(International symposium on use and development of low and medium flux research reactors, Cambridge, MA, USA, 17-19 Oct 1983)			
3	NTIS, PC A02/MF A01	DE84001987	MN -80	9:5940
6	*See* EGG-M-13683	DE84003808	MN -80	9:5947
7	NTIS, PC A02/MF A01; 1	DE84003456	MN -28	9:6465
CONF-831015-	(Nuclear science symposium, San Francisco, CA, USA, 19-21 Oct 1983)			
25	*See* PNL-SA-11337	DE84003258	MN -37	9:6562
CONF-831025-	(26. ORNL-DOE conference on analytical chemistry in energy technology, Knoxville, TN, USA, 11-13 Oct 1983)			
25	NTIS, PC A02/MF A01	DE84003619	MN -34C	9:6466
27	*See* LBL-16741	DE84002927	MN -4	9:6291
CONF-831036-	(Nuclear facilities operator training topical meeting, Madrid, Spain, 19-21 Oct 1983)			
1	*See* PNL-SA-11307	DE84002593	MN -80	9:5976
CONF-831047-	(American Nuclear Society winter meeting, San Francisco, CA, USA, 30 Oct-4 Nov 1983)			
97	*See* K/P-6770	DE84002449	MN -46	9:5810
101	*See* EGG-M-20283	DE84002224	MN -80	9:5791
103	*See* EGG-M-15983	DE84002767	MN -78	9:5963
109	NTIS, PC A02/MF A01	DE84003273	MN -02	9:6003
111	*See* EGG-TMI-M00583	DE84002893	MN -78	9:5965
113	NTIS, PC A02/MF A01	DE84003271	MN -78	9:5913
114	*See* HEDL-SA-2881-FP	DE84003812	MN -79b	9:5772
115	*See* HEDL-SA-2891-FP	DE84003771	MN -02	9:5773
116	*See* HEDL-SA-2900-FP	DE84003768	MN -02	9:5775
117	*See* HEDL-SA-2894-FP	DE84003769	MN -02	9:5774
118	*See* HEDL-SA-2901-FP	DE84003773	MN -02	9:5776
119	NTIS, PC A02/MF A01; 1	DE84003381	MN -80	9:5920
CONF-831048-	(Global carbon cycle - analysis of the natural cycle and implications of anthropogenic alterations for the next century, Knoxville, TN, USA, 31 Oct-2 Nov 1983)			
1	NTIS, PC A02/MF A01	DE84003390	MN -11	9:6581
2	NTIS, PC A03/MF A01	DE84003304	MN -11	9:6582
CONF-831063-	(American Institute of Chemical Engineers fall annual meeting, Washington, DC, USA, 30 Oct-3 Nov 1983)			
11	NTIS, PC A02/MF A01	DE84003295	MN -38	9:6382

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CONF-831086-	(Electrochemical Society fall meeting, Washington, DC, USA, 9-14 Oct 1983)			
9	NTIS, PC A02/MF A01; 1	DE84003998	MN -94ca	9:5984
CONF-8310104-	(Specialists meeting on yields and decay data of fission product nuclides, Upton, NY, USA, 24-27 Oct 1983)			
6	*See* LA-UR-83-3058	DE84003776	MN -34C	9:6290
CONF-8310111-	(11. DOE annual compatibility meeting, Livermore, CA, USA, 18-20 Oct 1983)			
11	*See* UCRL-89425	DE84003733	MN -4	9:6310
CONF-8310143-	(11. NRC water reactor safety research information meeting, Gaithersburg, MD, USA, 14-28 Oct 1983)			
6-Summ.	*See* SAND-83-1806C	DE84001752	MN -78	9:5922
27	*See* SAND-83-1862C	DE84002385	MN -78	9:5978
38	*See* EGG-M-19783	DE84002206	MN -78	9:5916
47	*See* EGG-M-22683	DE84002202	MN -78	9:5964
53	*See* BNL-NUREG-33809	DE84002870	MN -78	9:5953
55	NTIS, PC A02/MF A01	DE84003294	MN -80	9:5928
56	NTIS, PC A02/MF A01	DE84003293	MN -80	9:5958
59	NTIS, PC A03/MF A01	DE84003414	MN -78	9:5934
61	*See* PNL-SA-11634	DE84003259	MN -80	9:5933
62	*See* PNL-SA-11668	DE84003345	MN -41	9:6563
CONF-8310144-	(Specialists' workshop on fission gas behavior in safety experiments, Cadarache, France, 5-7 Oct 1983)			
4	NTIS, PC A02/MF A01	DE84000596	MN -78	9:5959
CONF-8310159-	(Joint symposium on compatibility of plastics/materials with explosives, propellents and pyrotechnics, Lake Ozark, MO, USA, 31 Oct-2 Nov 1983)			
5	*See* MLM-3109-OP	DE84002830	MN -35	9:6572
8	*See* MLM-3110(OP)	DE84002829	MN -45	9:6573
CONF-8310163-	(18. international thermal conductivity conference, Rapid City, SD, USA, 3-5 Oct 1983)			
10	*See* SAND-83-2362C	DE84003208	MN -25	9:6217
CONF-8310172-	(Advances in soft x-ray science and technology conference, Upton, NY, USA, 17-20 Oct 1983)			
6	*See* LA-UR-83-3156	DE84003775	MN -48	9:6680
7	*See* LBL-16296	DE84002900	MN -34A	9:6779
8	*See* LBL-16298	DE84002899	MN -34A	9:6780
9	*See* BNL-33874	DE84002859	MN -28	9:6453
CONF-8310176-	(International meeting on reduced enrichment for research and test reactors, Tokai, Japan, 24-31 Oct 1983)			
2	NTIS, PC A02/MF A01; 1	DE84003623	MN -80	9:5941
3	NTIS, PC A02/MF A01; 1	DE84003617	MN -80	9:5942
4	NTIS, PC A02/MF A01	DE84003679	MN -80	9:5943
6	NTIS, PC A02/MF A01	DE84003620	MN -80	9:5944
7	NTIS, PC A02/MF A01; 1	DE84003547	MN -80	9:5945
CONF-8310179-	(8. international symposium on polynuclear aromatic hydrocarbons, Columbus, OH, USA, 26-28 Oct 1983)			
4	*See* DOE/PC/40809-20	DE84002939	MN -4	9:6267
6	NTIS, PC A02/MF A01	DE84004019	MN -90a	9:6601
CONF-8310182-	(US fall DECUS symposium, Las Vegas, NV, USA, 24-28 Oct 1983)			
11	*See* LA-UR-83-3410	DE84003823	MN -32	9:6344
12	*See* LA-UR-83-3340	DE84003796	MN -32	9:7065
CONF-8310198-	(IAEA specialists on mechanical properties of structural materials, Chester, UK, 10-14 Oct 1983)			
3	NTIS, PC A03/MF A01; 1	DE84003325	MN -79h	9:6150
4	NTIS, PC A02/MF A01	DE84003611	MN -79a	9:6151
CONF-8310199-	(Rivers '83 symposium, New Orleans, LA, USA, 24-26 Oct 1983)			
3	NTIS, PC A02/MF A01	DE84003461	MN -11	9:6728
CONF-8310201-	(Combustion Institute fall meeting of the western states section, Los Angeles, CA, USA, 17-18 Oct 1983)			
2	NTIS, PC A02/MF A01	DE84003183	MN -4	9:6350
3	*See* LBL-16790	DE84003962	MN -4	9:6353
CONF-8310220-	(International specialty conference on the meteorology of acidic deposition, Hartford, CT, USA, 16-19 Oct 1983)			
1	NTIS, PC A02/MF A01	DE84003634	MN -11	9:6585
CONF-831105-	(Meeting of the Plasma Physics Division of the American Physical Society, Los Angeles, CA, USA, 7-11 Nov 1983)			
4	*See* UCRL-89448	DE84003736	MN -21	9:7055
CONF-831106-	(Topical meeting on safeguards technology - the process safeguards interface, Hilton Head Island, SC, USA, 28 Nov-1 Dec 1983)			
1	NTIS, PC A02/MF A01; 1	DE83015675	MN -78	9:5812
7	*See* LA-UR-83-3383	DE84003843	MN -15	9:5824
8	*See* LA-UR-83-3382	DE84003839	MN -15	9:5823
9	*See* LA-UR-83-3403	DE84003848	MN -15	9:5825
10	*See* LA-UR-83-3265	DE84003802	MN -15	9:5816
11	*See* LA-UR-83-3199	DE84003772	MN -15	9:5814
12	*See* LA-UR-83-3266	DE84003780	MN -15	9:5817
13	*See* LA-UR-83-3344	DE84003845	MN -15	9:5822
14	*See* LA-UR-83-3298	DE84003788	MN -15	9:5818
15	*See* LA-UR-83-3299	DE84003789	MN -15	9:5819
16	*See* LA-UR-83-3320	DE84003793	MN -15	9:5820
17	*See* LA-UR-83-3325	DE84003792	MN -15	9:5821

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18	*See* LA-UR-83-3252	DE84003801	MN -15	9:5815
CONF-831111-	(ASME winter annual meeting, Boston, MA, USA, 13-18 Nov 1983)			
9	*See* SAND-83-1631C	DE84002051	MN -62	9:5863
CONF-831112-	(Coal technology '83 - international coal utilization convention, Houston, TX, USA, 15-17 Nov 1983)			
1	IGT, 3424 South State St., IIT Center, Chicago, IL 60616		MN -90c	9:5666
CONF-831117-	(4. integrated data users workshop, Reston, VA, USA, 1-2 Nov 1983)			
1	NTIS, PC A02/MF A01; 1	DE84003389	MN -13	9:7077
CONF-831142-	(Automotive technology development contractor coordination meeting, Dearborn, MI, USA, 13-17 Nov 1983)			
2	NTIS, PC A02/MF A01	DE84003993	MN -96	9:6082
CONF-831171-	(American Vacuum Society meeting, Boston, MA, USA, 1-4 Nov 1983)			
16	NTIS, PC A02/MF A01	DE84003393	MN -20d	9:7037
CONF-831174-	(Materials Research Society annual meeting, Boston, MA, USA, 14-17 Nov 1983)			
23	NTIS, PC A02/MF A01	DE84003305	MN -34	9:6228
27	*See* LA-UR-83-3341	DE84003795	MN -70	9:5793
28	*See* UCRL-89439	DE84003738	MN -21	9:6366
29	*See* LA-UR-83-3295	DE84003799	MN -4	9:6297
30	*See* SAND-83-1423C	DE84003255	MN -25	9:6182
31	*See* PNL-SA-11426	DE84003346	MN -25	9:6328
34	*See* PNL-SA-11456	DE84003207	MN -70	9:5797
35	*See* LA-UR-83-3169	DE84003774	MN -25	9:6216
36	NTIS, PC A02/MF A01	DE84003302	MN -25	9:6211
37	*See* SAND-83-1440C	DE84003218	MN -25	9:6247
38	*See* PNL-SA-11488	DE84003891	MN -25	9:6180
39	NTIS, PC A02/MF A01	DE84003460	MN -25	9:6212
40	NTIS, PC A02/MF A01	DE84003632	MN -25	9:6147
41	*See* UCRL-89333	DE84003744	MN -4	9:6218
43	NTIS, PC A02/MF A01; 1	DE84003307	MN -96	9:6121
44	NTIS, PC A02/MF A01	DE84003455	MN -25	9:6148
45	NTIS, PC A02/MF A01	DE84004020	MN -25	9:6149
46	*See* SAND-83-1647C	DE84004994	MN -25	9:6248
47	NTIS, PC A02/MF A01; 1	DE84004021	MN -25	9:6213
CONF-831180-	(3. international symposium on the production and neutralization of negative ions and beams, Upton, NY, USA, 14-18 Nov 1983)			
5	*See* LA-UR-83-3273	DE84003797	MN -28	9:6474
6	*See* LA-UR-83-3246	DE84003805	MN -28	9:6472
7-Rev.1	*See* UCRL-89433-Rev.1	DE84003238	MN -34A	9:6782
9	*See* LA-UR-83-3254	DE84003800	MN -28	9:6473
CONF-831187-	(MMM conference, Pittsburgh, PA, USA, 8-11 Nov 1983)			
13	NTIS, PC A02/MF A01	DE84003622	MN -34	9:6229
16	NTIS, PC A02/MF A01	DE84003674	MN -34D	9:6230
CONF-831189-	(ORSA/TIMS joint national meeting, Orlando, FL, USA, 7-9 Nov 1983)			
1	*See* SAND-83-0958C	DE84002535	MN -80	9:5827
CONF-8311105-	(DOE/CEA meeting on defense waste management, Knoxville, TN, USA, 9-10 Nov 1983)			
4	NTIS, PC A02/MF A01	DE84003399	MN -70B	9:5786
CONF-8311106-	(International symposium on electromagnetic properties of atomic nuclei, Tokyo, Japan, 9-12 Nov 1983)			
1	NTIS, PC A02/MF A01	DE84003606	MN -34C	9:6919
CONF-8311109-	(Direct coal liquefaction contractor's review conference, Pittsburgh, PA, USA, 16-17 Nov 1983)			
1	NTIS, PC A02/MF A01	DE84003392	MN -90d	9:5667
CONF-831203-	(10. symposium on fusion engineering, Philadelphia, PA, USA, 5-9 Dec 1983)			
5	*See* UCRL-89271	DE84003241	MN -20b	9:7051
14	*See* UCRL-89435	DE84003745	MN -20b	9:7054
15	*See* UCRL-89260	DE84003731	MN -20b	9:7050
16	*See* UCRL-89237	DE84003732	MN -20b	9:7047
17	*See* UCRL-89272	DE84003742	MN -20b	9:6997
18	*See* UCRL-89521	DE84003749	MN -20b	9:7057
20	*See* UCRL-89236	DE84003740	MN -20b	9:6994
21	*See* UCRL-89235	DE84003739	MN -20b	9:7046
22	*See* UCRL-89273	DE84003750	MN -20	9:7052
23	*See* UCRL-89246	DE84003753	MN -20b	9:6996
24	*See* UCRL-89908	DE84003240	MN -20a	9:7058
25	*See* UCRL-89238	DE84003752	MN -20b	9:7048
26	*See* SAND-83-1621C	DE84003767	MN -21	9:7045
27	*See* UCRL-89255	DE84003239	MN -20b	9:7049
29	*See* UCRL-89244	DE84003741	MN -20b	9:6995
31	*See* UCRL-89320	DE84003746	MN -20b	9:7053
32	*See* LA-UR-83-3415	DE84003822	MN -20d	9:7044
CONF-831205-	(6. Miami international conference on alternative energy sources, Miami Beach, FL, USA, 12-14 Dec 1983)			
3	NTIS, PC A02/MF A01; 1	DE84003644	MN -13	9:6607
4	NTIS, PC A02/MF A01; 1	DE84003989	MN -94a	9:5981
CONF-831217-	(5. civilian radioactive waste management information meeting, Washington, DC, USA, 12-15 Dec 1983)			
1	*See* UCRL-90044	DE84003894	MN -70	9:5801

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CONF-831243-	(International electron device meeting, Washington, DC, USA, 5-7 Dec 1983)			
3	*See* SLAC-PUB-3214	DE84003516	MN -28	9:6399
CONF-831248-	(11. DOE/SNLA photovoltaic concentrator project integration meeting, Albuquerque, NM, USA, 13-14 Dec 1983)			
1	*See* SAND-83-2417C	DE84003764	MN -63c	9:5854
CONF-840110-	(IEEE conference on power apparatus and systems, New York, NY, USA, 1 Jan 1984)			
1	*See* SAND-83-7093C	DE83011789	MN -63	9:5858
CONF-840119-	(5. international symposium on finite element methods in flow problems, Austin, TX, USA, 23-26 Jan 1984)			
1	*See* SAND-83-0882C	DE84000063	MN -32	9:7072
CONF-840133-	(11. aerospace sciences meeting, Reno, NV, USA, 9-12 Jan 1984)			
1	*See* SAND-83-1392C	DE84003101	MN -38	9:6377
2	*See* SAND-83-1366C	DE84003254	MN -38	9:6376
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2383-0093	*See* UIUCDCS-R-83-1121	DE84003585	MN -32	9:7076
CSIR-CENG-				
445	*See* PB-83-247577			9:6375
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275	Deutsches Elektronen-Synchron (DESY), Hamburg (Germany, F.R.)			9:6828
278	Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)			9:6829
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82-05	*See* N-8326314			9:5848
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T1	NTIS, PC A02/MF A01; 1	DE84003509	MN -61a	9:5831
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12	NTIS, PC A08/MF A01; 1	DE84003522	STD -92a	9:5741
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1	NTIS, PC A16/MF A01; 1	DE84004855	STD -92a	9:7078
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21	NTIS, PC A06/MF A01	DE84002484	STD -92a	9:5742
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1395-6	NTIS, PC A05/MF A01	DE84003431	STD -92a	9:5743
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0027/ 2	NTIS, PC A02/MF A01	DE84004097	STD -96	9:6122
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1	NTIS, PC A03/MF A01; 1	DE84003597	STD -61	9:5832
2	NTIS, PC A03/MF A01	DE84003928	STD -61	9:5833
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T19	NTIS PC A03/MF A01	DE84003587	MN -95d	9:6064
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T1	NTIS, PC A06/MF A01; 1	DE84004969	MN -98D	9:5992
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T1	NTIS, PC A02/MF A01	DE84003654	MN -90d	9:5726
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T1	NTIS, PC A06/MF A01	DE84002866	MN -95d	9:6065
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T3	NTIS, PC A06/MF A01	DE84003984	MN -95f	9:6096
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T1	NTIS MF A01; 2	DE84001119	MN -59a	9:5869
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T1	NTIS, PC A11/MF A01; 1	DE84002241	STD -59a	9:5870
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T1	NTIS, PC A02/MF A01	DE84002444	MN -59	9:5871
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T1	NTIS, PC A07/MF A01; 1	DE84004122	MN -95f	9:6083
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T1	NTIS, PC A06/MF A01; 1	DE83017850	MN -95	9:6604
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1	NTIS, PC A03/MF A01; 1	DE84003809	MN -21	9:7038
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T1	NTIS, PC A03/MF A01	DE84002212	MN -98E	9:6031
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0109(83/ 11)	NTIS, PC A05/MF A01 - GPO	DE84003005	MN -98B	9:5749
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0430	NTIS, PC A03/MF A01 - GPO	DE84003276	MN -98	9:6010
0438	NTIS, PC A05/MF A01 - GPO	DE84003846	MN -98F	9:6004
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T3	NTIS, PC A06/MF A01; 1	DE84004985	MN -11	9:6005
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0184	NTIS, PC A03/MF A01	DE84003723	MN -13	9:7062

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T5	NTIS, PC A02/MF A01; 1	DE83003913	MN -34	9:6233
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218	NTIS, PC A03/MF A01	DE84004054	MN -28	9:6412
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203	NTIS, PC A02/MF A01	DE84004989	MN -32	9:6969
204	NTIS, PC A03/MF A01; 1	DE84004990	MN -32	9:7069
DOE/ER/03956-2	NTIS, PC A02/MF A01	DE84003445	MN -34D	9:6809
DOE/ER/04447-168	NTIS, PC A03/MF A01	DE84004907	MN -04	9:6293
DOE/ER/04971-5	NTIS, PC A02/MF A01	DE84003172	MN -34A	9:6760
DOE/ER/10361-4	NTIS, PC A02/MF A01	DE84003438	MN -25	9:6734
DOE/ER/10419-3	NTIS, PC A02/MF A01	DE84003442	MN -34D	9:6920
DOE/ER/10622-4	NTIS, PC A02/MF A01	DE84003170	MN -4	9:6266
DOE/ER/10632-5	NTIS, PC A02/MF A01	DE84003718	MN -4	9:6314
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DOE/ER/10896-3	NTIS, PC A02/MF A01; 1	DE84004045	MN -25	9:6234
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DOE/ET/10495-29	NTIS, PC A03/MF A01	DE84003370	STD -90d	9:5668
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107	NTIS, PC A06/MF A01; 1	DE84001262	MN -79b	9:5925
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DOE/ET/53051-60	NTIS, PC A06/MF A01; 1	DE84004869	STD -20	9:6987
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DOE/EV/05888-06	NTIS, PC A02/MF A01	DE84003441	MN -48	9:6615
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DOE/FE-0027	NTIS, PC A02/MF A01	DE84003986	STD -90f	9:6393
DOE/ID/12221-T1	NTIS, PC A15/MF A01; 1	DE84003575	MN -61a	9:5828
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DOE/PC/30019-T9	NTIS, PC A18/MF A01; 1	DE84003108	MN -90d	9:5835
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T18	NTIS, PC A04/MF A01; 1	DE84003936	MN -96	9:6094
DOE/R2/06031-1	NTIS, PC A14; 3	DE83014759	MN -95d	9:6066
DOE/R6/10952-T1	NTIS, PC A02/MF A01	DE84003452	MN -95d	9:6067
DOE/R6/10963-T1	NTIS, PC A03/MF A01	DE84003543	MN -95	9:6068
DOE/R6/10967-T1	NTIS, PC A02; 3	DE84003502	MN -63d	9:5857
DOE/R6/10970-T1	NTIS, PC A02/MF A01	DE84003489	MN -95d	9:6069
DOE/R6/10995-T1	NTIS, PC A03/MF A01; 1	DE84003127	MN -95	9:6100
DOE/R6/11995-T1	NTIS, PC A02/MF A01; 1	DE84003423	MN -61a	9:5836
DOE/R6/11996-T1	NTIS, PC A02/MF A01	DE84003487	MN -95d	9:6070

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DOE/R6/11998-T1	NTIS, PC A03/MF A01; 1	DE84003422	MN -59b	9:6071
DOE/R6/11999-T1	NTIS, PC A02/MF A01; 1	DE84003538	MN -95e	9:6120
DOE/R6/12002-T1	NTIS, PC A02/MF A01	DE84003122	MN -59a	9:5873
DOE/R6/12007-T1	NTIS, PC A02/MF A01; 1	DE84003233	MN -59c	9:5874
DOE/R6/12013-T1	NTIS, PC A04/MF A01; 1	DE84003136	MN -95	9:6101
DOE/R6/12016-T1	NTIS, PC A03/MF A01; 1	DE84003116	MN -59b	9:5859
DOE/R6/12021-T1	NTIS, PC A05/MF A01	DE84003119	MN -95d	9:6390
DOE/R6/12034-T1	NTIS, PC A04/MF A01; 1	DE84003129	MN -59	9:5875
DOE/R6/12056-T1	NTIS, PC A03/MF A01	DE84003544	MN -95e	9:6102
DOE/R6/12068-T1	NTIS, PC A02/MF A01	DE84003432	MN -61	9:6131
DOE/R6/12072-T1	NTIS, PC A02/MF A01	DE84003488	MN -95e	9:6103
DOE/R6/12086-T1	NTIS, PC A03/MF A01	DE84000050	MN -61a	9:5829
DOE/R6/12332-T1	NTIS, PC A02/MF A01	DE84003501	MN -59a	9:5876
DOE/RL/01830-T11	NTIS, PC A05/MF A01; 1	DE84002188	MN -96	9:6123
T12	NTIS, PC A03/MF A01	DE84002186	MN -96	9:6124
DOE/S-0024	NTIS, PC A04/MF A01	DE84003567	MN -78	9:5960
0027	NTIS, PC A03/MF A01	DE84003710	MN -13	9:6132
DOE/SF/00098-T2	NTIS, PC A03/MF A01; 1	DE84002187	MN -90h	9:6214
DOE/SF/10501-301	NTIS, PC A02/MF A01; 1	DE84002396	MN -62	9:5860
302	NTIS, PC A03/MF A01; 1	DE84002391	MN -62	9:5842
DOE/SF/11921-T1	NTIS, PC A02/MF A01	DE84002733	MN -62	9:5861
DOE/SR-WM-84-1-Rev.1	NTIS, PC A02/MF A01; 1	DE84004646	MN -70	9:5787
DOE/TIC/EG-82/ 139	NTIS, PC A06/MF A01; 1	DE84004601	MN -37	9:6384
DOE/WM/46642-1	NTIS, PC A02/MF A01	DE84004557	MN -70	9:5788
DP-1663	NTIS, PC A02/MF A01	DE84004047	STD -10	9:5777
DP-MS-82-90	NTIS, PC A05/MF A01	DE84003483	MN -25	9:6153
DPSPU-61-11-16	NTIS, PC A02; 3	DE84001535	MN -41	9:5789
DPST-80-110-4	NTIS, PC A02/MF A01	DE84003481	MN -70	9:5790
82-810	NTIS, PC A03/MF A01; 1	DE84003479	MN -80	9:5961
83-521	NTIS, PC A02/MF A01	DE84003480	MN -11	9:6696
83-639	NTIS, PC A02/MF A01	DE84003686	MN -80	9:5952
E-83-10325	*See* N-8327310			9:5757
83-10329	*See* N-8327313			9:6670
1546	*See* N-8326252			9:6044
1657	*See* N-8326253			9:5986
ECC/P-1	NTIS (US Sales Only), PC A02/MF A01	DE84900207	MN -78	9:5929
2	NTIS (US Sales Only), PC A04/MF A01	DE84900217	MN -78	9:5930
6	NTIS (US Sales Only), PC A03/MF A01	DE84900024	MN -78	9:5931
8	NTIS (US Sales Only), PC A02/MF A01	DE84900006	MN -78	9:5932
EGG-2241	NTIS, PC A06/MF A01	DE84003924	STD -95e	9:6104
EGG-M-04983	NTIS, PC A02/MF A01	DE84002892	MN -78	9:5946
06383	NTIS, PC A02/MF A01; 1	DE84001003	MN -78	9:5921
09383	NTIS, PC A02/MF A01	DE84000802	MN -80	9:5962
13683	NTIS, PC A02/MF A01	DE84003808	MN -80	9:5947
15983	NTIS, PC A02/MF A01	DE84002767	MN -78	9:5963
19783	NTIS, PC A02/MF A01	DE84002206	MN -78	9:5916
20283	NTIS, PC A02/MF A01	DE84002224	MN -80	9:5791
22683	NTIS, PC A02/MF A01; 1	DE84002202	MN -78	9:5964
EGG-PBS-6441	NTIS, PC A02/MF A01	DE84003807	MN -34C	9:6554
EGG-PHYS-6003-Rev.1	NTIS, PC A08/MF A01	DE84003847	MN -34C	9:6945
EGG-TMI-M00583	NTIS, PC A02/MF A01; 1	DE84002893	MN -78	9:5965
ENICO-1116-Suppl.1(10-83)	NTIS, PC A04/MF A01; 1	DE84003515	MN -11	9:5792

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EPA-				
230-09-007	US EPA, 401 M St., SW, Washington, DC 20460		MN -11	9:6587
EPRI-AP-				
3229	NTIS, PC A18/MF A01; 1	DE84003803	MN -20	9:7040
ERA-				
79-116	*See* ERATL-83/30			9:5908
ERATL-				
83/ 30	NTIS$45.00			9:5908
ESA-CR(P)-				
1696	*See* N-8326313			9:5847
ESA-TT-				
775	*See* N-8326314			9:5848
ESG-DOE-				
13414	NTIS, PC A04/MF A01	DE84003217	MN -33A	9:5966
EUR-				
7563-EN	ECIS, 2100 M St., NW, Suite 707, Washington, DC 20037		ND -61a	9:5830
7660-EN	Commission of the European Communities, Luxembourg			9:6125
8149-DE	*See* PB-83-242156			9:5850
8160-EN	*See* PB-83-248864			9:5851
8353-EN	Commission of the European Communities, Luxembourg			9:5882
8635-EN	NTIS (US Sales Only), PC A04/MF A01	DE84900368	MN -13	9:5994
8743-FR	European Community Information Service (ECIS), 2100 M Street, N.W., Suite 707, Washington, DC 20037		ND -62	9:5862
FCR-				
4930	NTIS, PC A03/MF A01	DE84001695	STD -93	9:6042
FE-				
2034-29	*See* DOE/ET/10495-29	DE84003370	STD -90d	9:5668
FERMILAB-CONF-				
83/ 76-EXP	NTIS, PC A02/MF A01	DE84003186	MN -34D	9:6816
FRNC-TH-				
1170	NTIS (US Sales Only), PC A04/MF A01	DE84700524	MN -34C	9:6900
FSEC-CR-				
84-83(RD)	NTIS, PC A04/MF A01; 1	DE84900008	MN -59	9:6072
93-83	NTIS, PC A05/MF A01	DE84000636	MN -59c	9:5877
FUB-				
12-1982	*See* N-8326356			9:5841
GA-A-				
17178	NTIS, PC A02/MF A01	DE84003811	MN -20a	9:6988
GAO/AFMD-				
83-92	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -13	9:5988
GAO/NSIAD-				
83-41	US GAO, PO Box 6015, Gaithersburg, MD 20760		MN -11	9:6000
83-69	US General Accounting Office, Document Handling and Information Services Facility, P.O. Box 6015, Gaithersburg, MD 20760		MN -98B	9:5753
GAO/RCED-				
83-112	US General Accounting Office, Document Handling and Information Services Facility, PO Box 6015, Gaithersburg, MD 20760		MN -89	9:5671
83-199	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760, $3.25		MN -11	9:5989
83-226	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760		MN -2	9:6006
83-234	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760		MN -98D	9:5990
GJBX-				
16(83)	NTIS, PC A03/MF A01	DE84004974	MN -51	9:5764
41(83)	NTIS, PC A12; 3	DE84003471	MN -51	9:5765
42(83)	NTIS, PC A03; 3	DE84003470	MN -51	9:5766
HEDL-SA-				
2793-FP	NTIS, PC A02/MF A01	DE84003790	MN -20c	9:6154
2881-FP	NTIS, PC A02/MF A01	DE84003812	MN -79b	9:5772
2891-FP	NTIS, PC A02/MF A01	DE84003771	MN -02	9:5773
2894-FP	NTIS, PC A02/MF A01; 1	DE84003769	MN -02	9:5774
2897	NTIS, PC A02/MF A01	DE84003954	MN -20c	9:6155
2900-FP	NTIS, PC A02/MF A01	DE84003768	MN -02	9:5775
2901-FP	NTIS, PC A02/MF A01	DE84003773	MN -02	9:5776
IEA/EAS-				
H3/ 82	IEA, 14/15 Lower Grosvenor Place, London SW1W 0EX England; 1		STD -90j	9:6026
INDC(JAP)-				
79/ L	*See* JAERI-M-83-127		MN -34C	9:6908
INIS-BR-				
60	NTIS (US Sales Only), PC A02/MF A01	DE83703965	MN -2	9:6007
62	NTIS (US Sales Only), PC A02/MF A01	DE83703933	MN -25	9:6156
63	NTIS (US Sales Only), PC A02/MF A01	DE83703934	MN -25	9:6157
64	NTIS (US Sales Only), PC A02/MF A01	DE83703935	MN -25	9:6158
65	NTIS (US Sales Only), PC A02/MF A01	DE83704621	MN -25	9:6159
66	NTIS (US Sales Only), PC A02/MF A01	DE83703936	MN -25	9:6160
67	NTIS (US Sales Only), PC A02/MF A01	DE83703937	MN -25	9:6161
68	NTIS (US Sales Only), PC A02/MF A01	DE83703938	MN -25	9:6162
69	NTIS (US Sales Only), PC A02/MF A01	DE83703939	MN -25	9:6163
70	NTIS (US Sales Only), PC A02/MF A01	DE83703940	MN -25	9:6164
71	NTIS (US Sales Only), PC A03/MF A01	DE83703941	MN -25	9:6165

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72	NTIS (US Sales Only), PC A02/MF A01	DE83703942	MN -25	9:6166
73	NTIS (US Sales Only), PC A02/MF A01	DE83703943	MN -25	9:6167
74	NTIS (US Sales Only), PC A02/MF A01	DE83703944	MN -25	9:6168
75	NTIS (US Sales Only), PC A02/MF A01	DE83703945	MN -25	9:6169
76	NTIS (US Sales Only), PC A02/MF A01	DE83703946	MN -25	9:6170
77	NTIS (US Sales Only), PC A02/MF A01	DE83703927	MN -25	9:6268
INIS-mf-				
8221	NTIS (US Sales Only), PC A04/MF A01	DE83703923	MN -34D	9:6864
8222	NTIS (US Sales Only), PC A03/MF A01	DE83703966	MN -32	9:5910
8223	NTIS (US Sales Only), PC A03/MF A01	DE83704622	MN -51	9:6732
8224	NTIS (US Sales Only), PC A09/MF A01	DE83703930	MN -4	9:6333
8225	NTIS (US Sales Only), PC A06/MF A01	DE83703926	MN -34C	9:6884
8227	NTIS (US Sales Only), PC A08/MF A01	DE83703931	MN -4	9:6309
8229	NTIS (US Sales Only), PC A05/MF A01	DE83703922	MN -34D	9:6916
8231	NTIS (US Sales Only), PC A10/MF A01	DE83703924	MN -34D	9:6817
8235	NTIS (US Sales Only), PC A10/MF A01	DE83703925	MN -34D	9:6930
8237	NTIS (US Sales Only), PC A13/MF A01	DE83704630	MN -41	9:7079
8239	NTIS (US Sales Only), PC A06/MF A01	DE83704631	MN -48	9:6643
8240	NTIS (US Sales Only), PC A07/MF A01	DE83704634	MN -48	9:6644
8241	NTIS (US Sales Only), PC A04/MF A01	DE83704629	MN -23	9:6645
8242	NTIS (US Sales Only), PC A07/MF A01	DE83704632	MN -48	9:6646
8243	NTIS (US Sales Only), PC A04/MF A01	DE83704620	MN -86	9:5778
8244	NTIS (US Sales Only), PC A07/MF A01	DE83704633	MN -48	9:6647
8245	NTIS (US Sales Only), PC A06/MF A01	DE83704612	MN -34C	9:6906
8246	NTIS (US Sales Only), PC A07/MF A01	DE83704605	MN -34D	9:6865
8247	NTIS (US Sales Only), PC A05/MF A01	DE83704606	MN -34A	9:6761
8248	NTIS (US Sales Only), PC A07/MF A01	DE83704623	MN -51	9:6736
8249	NTIS (US Sales Only), PC A05/MF A01	DE83704611	MN -34D	9:6837
8250	NTIS (US Sales Only), PC A04/MF A01	DE83704616	MN -34C	9:6890
8251	NTIS (US Sales Only), PC A05/MF A01	DE83704617	MN -34C	9:6897
8252	NTIS (US Sales Only), PC A04/MF A01	DE83704618	MN -34C	9:6912
8253	NTIS (US Sales Only), PC A06/MF A01	DE83704619	MN -34C	9:6907
8254	NTIS (US Sales Only), PC A04/MF A01	DE83704626	MN -48	9:6673
8255	NTIS (US Sales Only), PC A02/MF A01	DE83704635	MN -80	9:5967
8256	NTIS (US Sales Only), PC A07/MF A01	DE83704628	MN -48	9:6674
8258	NTIS (US Sales Only), PC A09/MF A01	DE83704624	MN -51	9:5767
8259	NTIS (US Sales Only), PC A04/MF A01	DE83704627	MN -48	9:6675
8261	NTIS (US Sales Only), PC A14/MF A01	DE84780039	MN -48	9:7080
8292	NTIS (US Sales Only), PC A04/MF A01	DE84700518	MN -34A	9:6171
8295	NTIS (US Sales Only), PC A06/MF A01	DE84700522	MN -34A	9:6235
8365	Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe (Germany, F.R.)			9:6364
8582	NTIS (US Sales Only), PC A06/MF A01	DE83703928	MN -48	9:6648
8586	NTIS (US Sales Only), PC A06/MF A01	DE83703932	MN -4	9:6343
8589	NTIS (US Sales Only), PC A05/MF A01	DE83703929	MN -80	9:6287
8591	NTIS (US Sales Only), PC A07/MF A01	DE84780040	MN -48	9:6640
8593	NTIS (US Sales Only), PC A03/MF A01	DE83704637	MN -2	9:6001
8594	NTIS (US Sales Only), PC A07/MF A01	DE83704625	MN -51	9:5768
8595	NTIS (US Sales Only), PC A03/MF A01	DE83704613	MN -34C	9:6891
8596	NTIS (US Sales Only), PC A02/MF A01	DE83704614	MN -34C	9:6932
8597	NTIS (US Sales Only), PC A02/MF A01	DE83704615	MN -34C	9:6892
8598	NTIS (US Sales Only), PC A02/MF A01	DE83704607	MN -34A	9:6763
8599	NTIS (US Sales Only), PC A02/MF A01	DE83704608	MN -34A	9:6764
8600	NTIS (US Sales Only), PC A02/MF A01	DE83704609	MN -34A	9:6765
8601	NTIS (US Sales Only), PC A02/MF A01	DE83704636	MN -37	9:6557
8669	NTIS (US Sales Only), PC A02/MF A01	DE84700516	MN -34A	9:6766
8670	NTIS (US Sales Only), PC A02/MF A01	DE84700523	MN -34C	9:6933
8671	NTIS (US Sales Only), PC A02/MF A01	DE84700525	MN -34C	9:6934
8672	NTIS (US Sales Only), PC A06/MF A01	DE84700519	MN -34A	9:6806
8681	NTIS (US Sales Only), PC A08/MF A01	DE84700520	MN -34B	9:6738
8682	NTIS (US Sales Only), PC A11/MF A01	DE84700521	MN -34B	9:6739
8683	NTIS (US Sales Only), PC A08/MF A01	DE84700517	MN -34A	9:6960
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180	NTIS (US Sales Only), PC A08/MF A01	DE84780038	MN -34D	9:6845
184	NTIS (US Sales Only), PC A03/MF A01	DE83704610	MN -34A	9:6961
196	NTIS (US Sales Only), PC A05/MF A01	DE84780041	MN -34D	9:6947
INPE-				
2698-PRE/ 294	*See* N-8326336			9:6577
JAERI-M-				
83-127	Information Section, Division of Technical Information, Japan Atomic Energy Research Institute, Tokai-mura, Naka-gun, Ibaraki-ken 319-11, Japan		MN -34C	9:6908
JPL-PUBL-				
83-40	*See* N-8326256			9:6032
JPRS-				
83467	*See* N-8326422			9:6682
83601	*See* N-8327572			9:6720
Juel-				
1834	Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe (Germany, F.R.)			9:6215
Juel-Spez-				
192	NTIS (US Sales Only), PC A13/MF A01; 1	DE84750341	MN -98	9:5995
193	Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe (Germany, F.R.)			9:6011

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K/CSD/TM-				
43	NTIS, PC A04/MF A01; 1	DE84003908	MN -32	9:7070
K/P-				
6770	NTIS, PC A02/MF A01; 1	DE84002449	MN -46	9:5810
KMSF-U-				
1315	NTIS, PC A03/MF A01	DE84002940	MN -21	9:7042
LA-				
9360	NTIS, PC A02/MF A01	DE84003564	STD -70	9:6576
9717-MS	NTIS, PC A03/MF A01	DE84003563	STD -20f	9:7043
9763-M	NTIS, PC A08/MF A01	DE84003978	STD -4	9:6288
9780-HDR	NTIS, PC A07/MF A01	DE84003699	STD -66b	9:5906
9784-MS	*See* NUREG/CR-3312	DE84003111	MN -78	9:5972
9787-PR	NTIS, PC A04/MF A01	DE84003969	STD -96	9:6043
9800-MS	NTIS PC E08/MF $6.75	DE84003557	STD -02	9:7064
9801-PR	NTIS, PC A03/MF A01	DE84003565	STD -91	9:5762
9841-PR	NTIS, PC A05/MF A01; 1	DE84003562	STD -34C	9:6880
9873-MS	NTIS, PC A03/MF A01	DE84003559	STD -34C	9:6917
9888-T	NTIS, PC A18/MF A01; 1	DE84003975	STD -04	9:6289
9898-MS	NTIS, PC A04/MF A01	DE84003972	STD -28	9:6414
9907-OBES	NTIS, PC A11/MF A01; 1	DE84002332	STD -11	9:5700
9910-MS-Vol.1	*See* NUREG/CR-3522-Vol.1	DE84003979	MN -25	9:5826
9913-MS	*See* NUREG/CR-3527	DE84004260	MN -80	9:5975
9935-MS	NTIS, PC A02/MF A01	DE84003970	STD -15	9:5813
LA-tr-				
83-18	NTIS, PC A03/MF A01; 1	DE84000747	MN -80	9:5782
83-22	NTIS, PC A02/MF A01; 1	DE84002625	MN -80	9:5979
LA-UR-				
83-3058	NTIS, PC A02/MF A01	DE84003776	MN -34C	9:6290
83-3156	NTIS, PC A02/MF A01	DE84003775	MN -48	9:6680
83-3169	NTIS, PC A02/MF A01	DE84003774	MN -25	9:6216
83-3199	NTIS, PC A02/MF A01	DE84003772	MN -15	9:5814
83-3200	NTIS, PC A02/MF A01; 1	DE84003782	MN -34C	9:6471
83-3205	NTIS, PC A03/MF A01; 1	DE84003779	MN -32	9:6374
83-3217	NTIS, PC A02/MF A01	DE84003786	MN -34B	9:6740
83-3246	NTIS, PC A02/MF A01	DE84003805	MN -28	9:6472
83-3252	NTIS, PC A02/MF A01	DE84003801	MN -15	9:5815
83-3254	NTIS, PC A02/MF A01	DE84003800	MN -28	9:6473
83-3265	NTIS, PC A02/MF A01	DE84003802	MN -15	9:5816
83-3266	NTIS, PC A02/MF A01; 1	DE84003780	MN -15	9:5817
83-3273	NTIS, PC A02/MF A01	DE84003797	MN -28	9:6474
83-3288	NTIS, PC A02/MF A01; 1	DE84003798	MN -28	9:6475
83-3295	NTIS, PC A02/MF A01	DE84003799	MN -4	9:6297
83-3298	NTIS, PC A02/MF A01	DE84003788	MN -15	9:5818
83-3299	NTIS, PC A02/MF A01; 1	DE84003789	MN -15	9:5819
83-3320	NTIS, PC A03/MF A01; 1	DE84003793	MN -15	9:5820
83-3325	NTIS, PC A02/MF A01	DE84003792	MN -15	9:5821
83-3340	NTIS, PC A03/MF A01; 1	DE84003796	MN -32	9:7065
83-3341	NTIS, PC A02/MF A01; 1	DE84003795	MN -70	9:5793
83-3344	NTIS, PC A02/MF A01	DE84003845	MN -15	9:5822
83-3359	NTIS, PC A02/MF A01	DE84003831	MN -34D	9:6823
83-3382	NTIS, PC A02/MF A01; 1	DE84003839	MN -15	9:5823
83-3383	NTIS, PC A02/MF A01	DE84003843	MN -15	9:5824
83-3403	NTIS, PC A02/MF A01	DE84003848	MN -15	9:5825
83-3410	NTIS, PC A02/MF A01; 1	DE84003823	MN -32	9:6344
83-3415	NTIS, PC A02/MF A01	DE84003822	MN -20d	9:7044
LALP-				
83-45	NTIS, PC A02/MF A01	DE84003682	MN -02	9:6560
LBL-				
13618	NTIS, PC A04/MF A01	DE84003922	STD -94cc	9:6312
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16034	NTIS, PC A02/MF A01	DE84003051	MN -28	9:6415
16103	NTIS, PC A02/MF A01	DE84002926	MN -4	9:6588
16140	NTIS, PC A05/MF A01; 1	DE84003915	MN -34	9:6807
16291	NTIS, PC A02/MF A01	DE84002905	MN -34D	9:6948
16296	NTIS, PC A02/MF A01	DE84002900	MN -34A	9:6779
16298	NTIS, PC A02/MF A01	DE84002899	MN -34A	9:6780
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16522	NTIS, PC A02/MF A01	DE84004961	MN -94cc	9:5985
16607	NTIS, PC A02/MF A01	DE84002914	MN -28	9:6358
16639	NTIS, PC A02/MF A01; 1	DE84002911	MN -21	9:6398
16641	NTIS, PC A02/MF A01	DE84002906	MN -28	9:6477
16679	NTIS, PC A17/MF A01; 1	DE84003919	STD -94cd	9:6313
16741	NTIS, PC A02/MF A01	DE84002927	MN -4	9:6291
16773	NTIS, PC A05/MF A01	DE84003923	STD -90d	9:5672
16785	NTIS, PC A02/MF A01	DE84002181	MN -94c	9:5846
16790	NTIS, PC A04/MF A01; 1	DE84003962	MN -4	9:6353
16867	NTIS, PC A07/MF A01; 1	DE84004967	MN -90a	9:5755
MLM-				
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3109-OP	NTIS, PC A02/MF A01	DE84002830	MN -35	9:6572
3110(OP)	NTIS, PC A02/MF A01	DE84002829	MN -45	9:6573
3120	NTIS, PC A04/MF A01	DE84004049	STD -90c	9:5675
MLM-MU-				
83-71-0001	NTIS, PC A08/MF A01	DE84004978	MN -90	9:5676

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MPI-PAE-EXP.EL-				
115	Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.)			9:6561
MTI/WDC-				
82TR506	NTIS, PC A05; 3	DE84003884	MN -95f	9:5837
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8326122	NTIS, PC A06			9:6737
8326252	NTIS, PC A03/MF A05			9:6044
8326253	NTIS, PC A02/MF A01			9:5986
8326256	NTIS, PC A04/MF A01			9:6032
8326260	NTIS, PC A04/MF A01			9:6012
8326313	NTIS, PC A03/MF A01			9:5847
8326314	NTIS, PC A10/MF A01			9:5848
8326319	NTIS, PC A14/MF A01			9:6602
8326333	NTIS, PC A02/MF A01			9:6755
8326336	NTIS, PC A03/MF A01			9:6577
8326356	NTIS, PC A04/MF A01			9:5841
8326400	NTIS, PC A16/MF A01			9:6711
8326405	NTIS, PC A16/MF A01			9:6712
8326407	NTIS, PC A16/MF A01			9:6681
8326411	NTIS, PC A16/MF A01			9:6713
8326419	NTIS, PC A16/MF A01			9:6603
8326422	NTIS, PC A07			9:6682
8326423	NTIS, PC A07			9:6949
8326424	NTIS, PC A07			9:6954
8327310	NTIS, PC A03/MF A01			9:5757
8327313	NTIS, PC A02/MF A01			9:6670
8327351	NTIS, PC A13/MF A01			9:6045
8327352	NTIS, PC A13/MF A01			9:6046
8327366	NTIS, PC A06/MF A01			9:5849
8327375	NTIS, PC A13/MF A01			9:5905
8327478	NTIS, PC A04/MF A01			9:6578
8327515	NTIS, PC A03/MF A01			9:6579
8327519	NTIS, PC A02/MF A01			9:6756
8327572	NTIS, PC A03			9:6720
8327573	NTIS, PC A03			9:6649
8327574	NTIS, PC A03			9:6721
8327576	NTIS, PC A03			9:6722
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168278	*See* DOE/NASA-0131-2	DE84004834	MN -38	9:6373
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170383	*See* N-8327310			9:5757
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5-23T(4/ 81) (Rev.)	Nuclear Standards Management Center, Oak Ridge, TN		STD -80	9:5927
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21	*See* N-8326319			9:6602
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4770053	NTIS (US Sales Only), PC A11/MF A01; 1	DE84770053	MN -96	9:6128
4770054	NTIS (US Sales Only), PC A07/MF A01	DE84770054	MN -88	9:5717
4770055	NTIS (US Sales Only), PC A06/MF A01	DE84770055	MN -88	9:5718
4770056	NTIS (US Sales Only), PC A09/MF A01; 1	DE84770056	MN -88	9:5719
4770057	NTIS (US Sales Only), PC A07/MF A01	DE84770057	MN -88	9:5720
4770058	NTIS (US Sales Only), PC A04/MF A01	DE84770058	MN -34	9:6956
4770059	NTIS (US Sales Only), PC A10/MF A01; 1	DE84770059	MN -88	9:5721
4770060	NTIS (US Sales Only), PC A08/MF A01	DE84770060	MN -88	9:5722
4770061	NTIS (US Sales Only), PC A02/MF A01	DE84770061	MN -98F	9:6013
4770062	NTIS (US Sales Only), PC A02/MF A01	DE84770062	MN -98F	9:6014
4770063	NTIS (US Sales Only), PC A02/MF A01	DE84770063	MN -98F	9:6015
4770064	NTIS (US Sales Only), PC A02/MF A01	DE84770064	MN -98F	9:6016
4770065	NTIS (US Sales Only), PC A05/MF A01; 1	DE84770065	MN -92b	9:5752
4770066	NTIS (US Sales Only), PC A02/MF A01	DE84770066	MN -98F	9:6017
4770067	NTIS (US Sales Only), PC A02/MF A01	DE84770067	MN -98F	9:6018
4900010	USDI, Minerals Management Service, 1340 W Sixth St., Los Angeles, CA 90017		MN -11	9:6609
4900199	NTIS, PC A12/MF A01; 1	DE84900199	MN -59a	9:5878
4900206	NTIS, PC A03; 3	DE84900206	MN -11	9:6610
4900333	NTIS, PC A02/MF A01	DE84900333	MN -98B	9:6027
4900384	NTIS, PC A02/MF A01	DE84900384	MN -95d	9:6074
4900389	NTIS, PC A02/MF A01	DE84900389	MN -92	9:5754
4900398	NTIS, PC A02/MF A01	DE84900398	MN -98C	9:5758
4900399	NTIS, PC A03/MF A01	DE84900399	MN -98C	9:5759
4900400	NTIS, PC A02/MF A01; 1	DE84900400	MN -98	9:5996
4900401	NTIS, PC A02/MF A01; 1	DE84900401	MN -98	9:6021
4900402	NTIS, PC A02/MF A01; 1	DE84900402	MN -98A	9:5736
4900403	NTIS, PC A02/MF A01	DE84900403	MN -98C	9:6022

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4900404	USDI Minerals Management Service, 1340 W Sixth St., Los Angeles, CA 90017		MN -11	9:6611
4900503	NTIS, PC A02/MF A01	DE84900503	MN -90h	9:5694
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0849(83)	NTIS, PC A03/MF A01 - GPO $3.75	DE84900245	MN -80	9:5968
1016	NTIS, PC A05/MF A01; 1 - GPO $4.75	DE84900034	MN -80	9:5948
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2808	NTIS, PC A05/MF A01- GPO $4.50	DE84004561	MN -70B	9:5811
2830	NTIS, PC A06/MF A01; 1 - GPO $4.75	DE84002898	MN -80	9:5936
2870	NTIS, PC A05/MF A01 - GPO $4.75	DE84004565	MN -70	9:5794
2977	NTIS, PC A04/MF A01 - GPO $4.50	DE84004733	MN -70	9:5795
3154	NTIS, PC A04/MF A01 - GPO	DE84003583	MN -78	9:5917
3266	NTIS, PC A06/MF A01 - GPO $4.75	DE84001377	MN -80	9:5970
3297	NTIS, PC A06/MF A01; 1 - GPO $4.75	DE84004560	MN -78	9:5971
3312	NTIS, PC AA04/MF A01 - GPO	DE84003111	MN -78	9:5972
3334-Vol.2	NTIS, PC A07/MF A01 - GPO	DE84003981	MN -78	9:5918
3428	NTIS, PC A14/MF A01 - GPO	DE84003729	MN -78	9:5973
3522-Vol.1	NTIS, PC A03/MF A01 - GPO	DE84003979	MN -25	9:5826
3525	NTIS, PC A05/MF A01; 1 - GPO	DE84004921	MN -78	9:5974
3527	NTIS, PC A05/MF A01 - GPO	DE84004260	MN -80	9:5975
3536	NTIS, PC A03/MF A01 - GPO	DE84003958	MN -71	9:6359
3548	NTIS, PC A08/MF A01 - GPO	DE84002387	MN -80	9:5937
NYSERDA-				
83-7	NTIS, PC A10/MF A01	DE84004833	MN -94	9:5987
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163	NTIS, PC A16/MF A01	DE84003478	MN -13	9:7071
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83/ 4	NTIS, PC A21/MF A01; 1	DE84004145	MN -90	9:5677
ORNL/NSIC-				
200-Vol.2-No.10	*See* NUREG/CR-2000-Vol.2-No.10	DE84003766	MN -80	9:5969
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8647	*See* NUREG/CR-3154	DE84003583	MN -78	9:5917
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8905	NTIS, PC A04/MF A01	DE84004572	MN -90i	9:5735
8963	NTIS, PC A02/MF A01	DE84004126	MN -94a	9:5982
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5060	NTIS, PC A04/MF A01	DE84004956	MN -11	9:6597
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2408-217	*See* DOE/ER/02408-217	DE84004053	MN -34C	9:6903
2408-218	*See* DOE/ER/02408-218	DE84004054	MN -28	9:6412
P-				
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83-242156	NTIS PC E03/MF E03			9:5850
83-244541	NTIS$25.00			9:6036
83-245837	NTIS, PC A05/MF A01			9:6391
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83-252122	NTIS, PC A05/MF A01			9:5852
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83-257402	NTIS, PC A04/MF A01			9:6115
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4608-4	NTIS, PC A03/MF A01	DE84003755	MN -70A	9:5806
4713	NTIS, PC A03/MF A01	DE84003192	MN -11	9:6596
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11218	NTIS, PC A02/MF A01	DE84003206	MN -70	9:5796
11307	NTIS, PC A02/MF A01	DE84002593	MN -80	9:5976
11337	NTIS, PC A02/MF A01	DE84003258	MN -37	9:6562

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11426	NTIS, PC A02/MF A01	DE84003346	MN -25	9:6328
11456	NTIS, PC A02/MF A01; 1	DE84003207	MN -70	9:5797
11488	NTIS, PC A02/MF A01	DE84003891	MN -25	9:6180
11599	NTIS, PC A02/MF A01	DE84000149	MN -80	9:5977
11634	NTIS, PC A02/MF A01	DE84003259	MN -80	9:5933
11668	NTIS, PC A02/MF A01; 1	DE84003345	MN -41	9:6563
PNL-tr-				
436	NTIS, PC A02/MF A01; 1	DE84001199	MN -4	9:6263
437	NTIS, PC A03/MF A01; 1	DE84002815	MN -70	9:5803
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2045	NTIS, PC A02/MF A01	DE84003466	STD -20	9:6991
2050	NTIS, PC A03/ MF A01	DE84003465	STD -20g	9:6992
2058	NTIS, PC A03/MF A01	DE84003464	STD -20	9:6993
PTB-E-				
23	Fachinformationszentrum Energie, Mathematik, Physik, Karlsruhe (Germany, F.R.)			9:6565
REPT-				
37-155/ NT	*See* N-8326313			9:5847
RFP-				
3542	NTIS, PC A02/MF A01	DE84003458	STD -70	9:5798
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419	NTIS, PC A02/MF A01	DE84002602	MN -4	9:6725
RHO-PB-SR-				
10-B-CP-Oct.83	NTIS, PC A03/MF A01	DE84004567	MN -70	9:5780
10-B-WM-Oct.83	NTIS, PC A04/MF A01	DE84004611	MN -70	9:5799
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83-1-3Q-P	NTIS, PC A02/MF A01	DE84004564	MN -70	9:6181
SAND-				
81-0912	NTIS, PC A04/MF A01	DE84003366	MN -70	9:5800
82-1016	NTIS, PC A03/MF A01	DE84003316	MN -60	9:5909
83-0432	NTIS, PC A02/MF A01	DE84003340	MN -13	9:6360
83-0882C	NTIS, PC A02/MF A01	DE84000063	MN -32	9:7072
83-0958C	NTIS, PC A02/MF A01	DE84002535	MN -80	9:5827
83-1052	NTIS, PC A03/MF A01; 1	DE84003368	MN -32	9:7073
83-1144	NTIS, PC A11/MF A01	DE84003250	MN -63c	9:5853
83-1366C	NTIS, PC A02/MF A01; 1	DE84003254	MN -38	9:6376
83-1392C	NTIS, PC A02/MF A01	DE84003101	MN -38	9:6377
83-1423C	NTIS, PC A02/MF A01; 1	DE84003255	MN -25	9:6182
83-1440C	NTIS, PC A02/MF A01	DE84003218	MN -25	9:6247
83-1621C	NTIS, PC A02/MF A01	DE84003767	MN -21	9:7045
83-1631C	NTIS, PC A02/MF A01; 1	DE84002051	MN -62	9:5863
83-1647C	NTIS, PC A02/MF A01	DE84004994	MN -25	9:6248
83-1668C	NTIS, PC A02/MF A01	DE84003762	MN -38	9:6387
83-1806C	NTIS, PC A02/MF A01; 1	DE84001752	MN -78	9:5922
83-1862C	NTIS, PC A02/MF A01; 1	DE84002385	MN -78	9:5978
83-1927	NTIS, PC A02/MF A01	DE84003332	MN -32	9:6970
83-2004	NTIS, PC A03/MF A01; 1	DE84003726	MN -13	9:6249
83-2103	NTIS, PC A05/MF A01	DE84003600	STD -91	9:5761
83-2362C	NTIS, PC A02/MF A01	DE84003208	MN -25	9:6217
83-2417C	NTIS, PC A02/MF A01	DE84003764	MN -63c	9:5854
83-2464C	NTIS, PC A02/MF A01	DE84003249	MN -25	9:6724
83-7093C	NTIS, PC A02/MF A01; 1	DE83011789	MN -63	9:5858
83-7134	NTIS, PC A05/MF A01	DE84004854	STD -32	9:6962
83-7457	NTIS, PC A05/MF A01; 1	DE84002861	MN -37	9:6566
SERI/STR-				
254-2085	NTIS, PC A08/MF A01; 1	DE84000021	STD -59c	9:5879
SERI/TP-				
252-2105	NTIS, PC A02/MF A01	DE84000019	MN -62e	9:5864
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8	NTIS, PC A02/MF A01	DE84003901	MN -28	9:6416
SLAC-PUB-				
3214	NTIS, PC A02/MF A01	DE84003516	MN -28	9:6399
3217	NTIS, PC A02/MF A01	DE84003519	MN -28	9:6478
3218	NTIS, PC A02/MF A01	DE84003518	MN -28	9:6479
3227	NTIS, PC A02/MF A01	DE84003517	MN -28	9:6400
3229	NTIS, PC A02/MF A01; 1	DE84003520	MN -28	9:6417
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83-16	NTIS, PC A04/MF A01	DE84002098	STD -95d	9:6078
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82-R-5015-13	*See* PB-83-255422			9:6111
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091	*See* DOE/SF/10501-301	DE84002396	MN -62	9:5860
603	*See* DOE/SF/10501-302	DE84002391	MN -62	9:5842
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TENRAC/EDF-				
085-Vol.2A	NTIS, PC A11;MF A01; 1	DE84900424	MN -92	9:5997
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087	NTIS, PC A06/MF A01; 1	DE84900417	MN -92a	9:5737
093	NTIS, PC A03/MF A01	DE84900436	MN -95	9:6079
105	NTIS, PC A05/MF A01; 1	DE84900434	MN -92	9:5738
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117	NTIS, PC A03/MF A01; 1	DE84900416	MN -59c	9:5884
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UCID-				
18991-82	NTIS, PC A02/MF A01	DE84004861	MN -98	9:6035
19723	NTIS, PC A02/MF A01	DE84004860	MN -97b	9:5919
19850	NTIS, PC A19/MF A01; 1	DE84003139	MN -38	9:6361
19902	NTIS, PC A04/MF A01; 1	DE84003912	MN -32	9:6781
19905	NTIS, PC A04/MF A01	DE84003514	MN -13	9:7066
19937	NTIS, PC A03/MF A01	DE84003361	MN -32	9:7074
19940	NTIS, PC A02/MF A01; 1	DE84003914	MN -34	9:7075
UCRL-				
53440	NTIS, PC A05/MF A01	DE84003909	STD -70	9:6345
53483	*See* NUREG/CR-3428	DE84003729	MN -78	9:5973
53492	*See* NUREG/CR-3536	DE84003958	MN -71	9:6359
88922	NTIS, PC A02/MF A01; 1	DE84003895	MN -28	9:6418
89215	NTIS, PC A02/MF A01	DE84003751	MN -21	9:6365
89235	NTIS, PC A02/MF A01	DE84003739	MN -20b	9:7046
89236	NTIS, PC A02/MF A01	DE84003740	MN -20b	9:6994
89237	NTIS, PC A02/MF A01; 1	DE84003732	MN -20b	9:7047
89238	NTIS, PC A02/MF A01	DE84003752	MN -20b	9:7048
89244	NTIS, PC A02/MF A01	DE84003741	MN -20b	9:6995
89246	NTIS, PC A02/MF A01	DE84003753	MN -20b	9:6996
89255	NTIS, PC A02/MF A01	DE84003239	MN -20b	9:7049
89260	NTIS, PC A02/MF A01	DE84003731	MN -20b	9:7050
89271	NTIS, PC A02/MF A01	DE84003241	MN -20b	9:7051
89272	NTIS, PC A02/MF A01	DE84003742	MN -20b	9:6997
89273	NTIS, PC A02/MF A01	DE84003750	MN -20	9:7052
89320	NTIS, PC A02/MF A01	DE84003746	MN -20b	9:7053
89333	NTIS, PC A02/MF A01; 1	DE84003744	MN -4	9:6218
89425	NTIS, PC A02/MF A01	DE84003733	MN -4	9:6310
89433-Rev.1	NTIS, PC A03/MF A01	DE84003238	MN -34A	9:6782
89435	NTIS, PC A02/MF A01	DE84003745	MN -20b	9:7054
89439	NTIS, PC A02/MF A01; 1	DE84003738	MN -21	9:6366
89448	NTIS, PC A02/MF A01	DE84003736	MN -21	9:7055
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US United States of America (USA)
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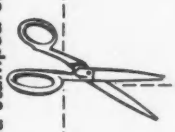

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